Preliminary Report
of
The Hakuhō Maru Cruise KH-75-4

June 21 - August 18, 1975
The northern North Pacific
and the Bering Sea

Ocean Research Institute
University of Tokyo
1977

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p.46, line 15	(Fig.4)	(Fig.3)
p.53, Table 35 title	Submarine irradiance and transparency in the Bering Sea	Submarine irradiance and transparency in the Bering Sea and the northern North Pacific
p.56, line 11 (from bottom)	for a 3 hr.	for 3 hr.
p.61, line 2	30 of the sea water	30 l of the sea water
p.64, line 5 (from bottom)	Three hydred	Three hundred
p.77, line 6	Tsuji (1975)	Tsuji et al. (1976)
p.87, line 5	Fig.15	Fig.14

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By
The Scientific Members of the Expedition
Edited by
Akihiko HATTORI

1977

Preface

The KH-75-4 Cruise of the R. V. Hakuho Maru of the University of Tokyo was conducted June 21 through August 18, 1975. This volume contains the hydrographic data obtained on the cruise and brief summaries of the research work carried out by individual scientists aboard.

The importance of integrated oceanographic research on such problems as why and how high biological productivity in the boreal areas of the northern North Pacific and the Bering Sea are maintained was discussed and recognized in the International Symposium for the Oceanographic Studies of the Bering Sea* held in Hakodate in 1972 and the succeeding US-Japan Seminar** held in Fairbanks in 1974. This cruise forms an initial and preliminary phase of the integrated and international research program recommended by these conferences.

Twenty seven scientists from 8 universities and research institutions participated in this cruise, and the study was undertaken under an interdisciplinary coordination.

On behalf of the scientists aboard, I wish to express my appreciation to Captain I. Tadama, the other officers and the crew members of the Hakuho Maru for their capable cooperation. I also acknowledge Dr. D. W. Hood, Institute Marine Science, University of Alaska, and Mr. Kent Turner, the Captain of the R. V. Acona, for their kind assistance in making this cruise possible and successful, Drs. G. L. Pickard and T. R. Parsons, Institute of Oceanography, University of British Columbia, and Drs. G. H. Geen and M. Waldichuk,

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* D. W. Hood and E. J. Kelley, eds, 1974. Oceanography of the Bering Sea. Occasional Publication No. 2, Institute of Marine Science, University of Alaska, Fairbanks, 623 pp.

** D. W. Hood and Y. Takenouti, eds, 1975. Bering Sea Oceanography: An Update. Institute of Marine Science, University of Alaska, Fairbanks, 292 pp.

Department of Environment, Canada, for their hospitality during our visit to Vancouver, and Miss Masae Ohtsu, for her help in compiling this volume.

Akihiko Hattori
Chief Scientist
Ocean Research Institute
University of Tokyo

Contents

Outline of the cruise

The cruise consisted of three legs: Leg 1, from Tokyo to Dutch Harbor, Alaska; Leg 2, from Dutch Harbor, Alaska, to Vancouver, B. C.; and Leg 3, from Vancouver, B. C. to Tokyo (Fig. 1). The location of the hydrographic stations and the dates are given in Table 1.

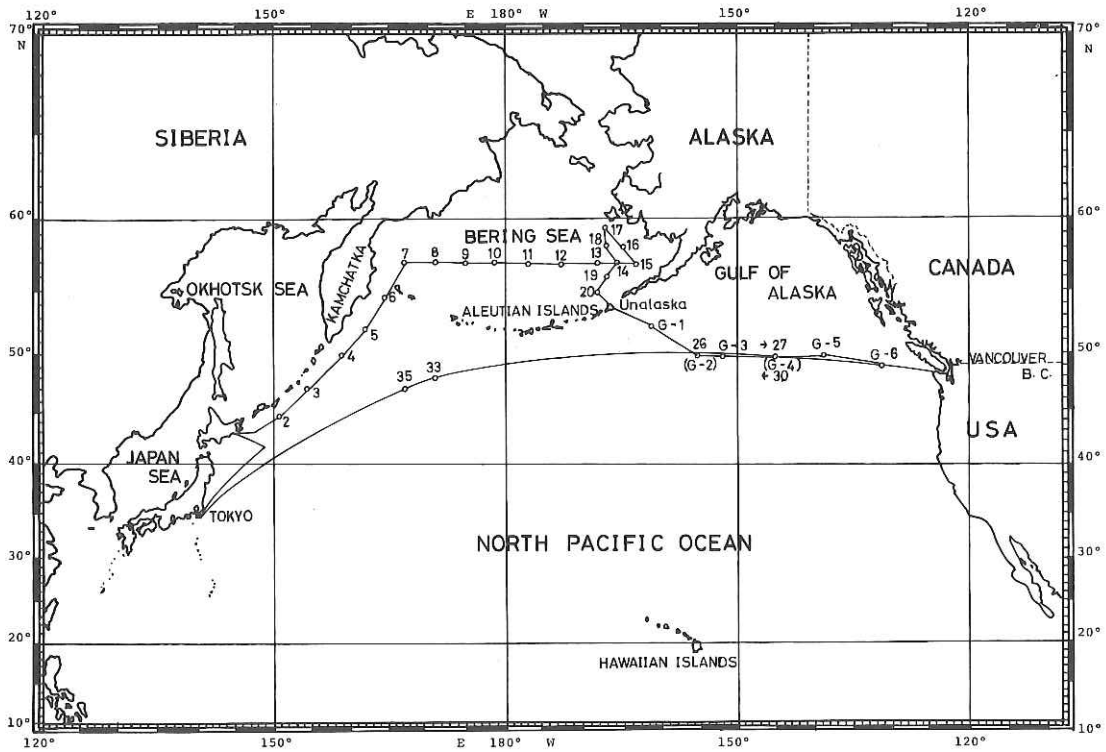

Fig. 1. Track chart of the KH-75-4 Cruise of the Hakuho Maru

Emphasis was placed on chemical, biochemical and biological aspects with special reference to cycling of biophilic elements. At each station, information was collected for: (1) distribution of temperature and salinity (2) distribution of oxygen, nutrients, chlorophylls, trace metals, dissolved and particulate organic matter, stable and radioactive nuclides, and (3) distribution of phytoplankton, zooplankton and micronekton. The ship board experiments were simultaneously carried out with respect to carbon, nitrogen and silica metabolism, using isotope tracer techniques. Experiments were also made to examine the possible effects of naturally occurring trace metals on the ecosystem.

At selected stations, some bottom sediment samples were collected using piston core samplers and/or gravity core samplers to examine their chemical and geological characteristics. Current meters and sediment traps were also installed to obtain direct information for water movement and vertical transfer of particulate matter. Solar radiation and gravity were continuously recorded throughout the cruise.

The names and specialities of the 27 scientists who participated in this cruise are listed in Table 2.

Table 1. Location of hydrographic stations and dates

Stations	Latitudes	Longitudes	Dates	
Leave Tokyo			6/21	1400
2	44°31.0'-44°34.5'N	151°01.0'-150°58.8'E	6/26-6/27	2205-0328
4	49°30.7'-49°39.1'	158°03.5'-158°02.2'	6/29	0131-1214
5	51°59.8'-51°59.6'	161°59.6'-162°05.6'	6/30	0525-1555
6	54°30.4'-54°36.8'	164°25.0'-164°34.1'	7/ 1	0706-2044
7	56°59.3'-57°00.1'	167°00.5'-167°01.5'	7/ 2-7/ 4	0935-1706
8	57°00.1'-57°00.0'	171°00.4'-171°04.8'	7/ 5	0347-1243
9	56°59.9'-56°59.8'	174°58.7'-174°53.6'	7/ 6	0013-1403
10	57°00.7'-57°01.8'	178°59.9'-179°15.8'	7/ 7	0105-1605
11	57°00.3'-57°09.6'	177°00.0'-177°11.0'W	7/ 7-7/ 8	0200-1320
12	57°00.4'-57°01.0'	172°28.7'-172°28.2'	7/ 9	0519-1038
13	56°59.5'-56°58.5'	168°00.5'-167°59.6'	7/ 9-7/10	2259-0146
14	56°58.8'-56°59.4'	165°36.1'-165°31.6'	7/10	0903-1346
15	56°59.6'-56°59.6'	162°59.0'-162°52.7'	7/10	2045-2258
16	58°15.2'-58°17.2'	164°55.9'-164°54.3'	7/11	0644-0821
17	59°30.8'-59°34.5'	166°58.3'-167°00.3'	7/11	1707-1944
18	58°15.7'-58°17.2'	167°01.0'-167°00.1'	7/12	0548-0733
19	56°00.3'-55°59.6'	167°00.0'-167°01.1'	7/13	0029-0229
20	54°59.7'-55°02.2'	168°00.7'-168°08.5'	7/13	0830-1957
Arrive Dutch Harbor			7/14	0900
Leave Dutch Harbor			7/16	1400
G-1	52°09.9'-52°09.5'	161°01.6'-161°01.4'	7/17	0810-0857
G-2 (26)	49°59.7'-49°56.7'	155°00.1'-155°04.8'	7/18	0613-2153
G-3	49°57.5'-49°58.1'	151°38.9'-151°36.7'	7/19	0805-0844
G-4 (27)	49°59.6'-50°01.1'	144°40.9'-144°29.5'	7/20	0517-1005
G-5	49°54.5'-49°54.7'	138°48.1'-138°48.2'	7/21	0804-0837
G-6	49°20.3'-49°20.7'	131°20.8'-131°22.1'	7/22	0804-0847
30	49°59.2'-50°01.0'	144°28.2'-145°02.6'	8/ 2-8/ 4	1923-0954
33	47°55.9'-47°56.2'	171°00.7'-170°57.7'	8/11	0505-2150
35	46°58.1'-46°56.8'	167°00.8'-167°00.7'	8/12	1137-1557

Table 2. Scientists aboard

Akihiko HATTORI Chief Scientist	Ocean Res. Inst., Univ. of Tokyo	Biochemistry
Takahisa NEMOTO	Ocean Res. Inst., Univ. of Tokyo	Biology
Toshisuke NAKAI	Ocean Res. Inst., Univ. of Tokyo	Physical Oceanography
Hirotaka OTOBE	Ocean Res. Inst., Univ. of Tokyo	Physical Oceanography
Kenichi SATAKE	Ocean Res. Inst., Univ. of Tokyo	Biochemistry
Isao KOIKE	Ocean Res. Inst., Univ. of Tokyo	Biochemistry
Toshiro SAINO	Ocean Res. Inst., Univ. of Tokyo	Biochemistry
Hitoshi IIZUMI	Ocean Res. Inst., Univ. of Tokyo	Biochemistry
Takashi ISHIMARU	Ocean Res. Inst., Univ. of Tokyo	Biology
Hiromi FUJIMOTO	Ocean Res. Inst., Univ. of Tokyo	Geophysics
Shizuo TSUNOGAI	Fac. Fisheries, Hokkaido Univ.	Geochemistry
Masao MINAGAWA	Fac. Fisheries, Hokkaido Univ.	Geochemistry
Shigeki KONISHI	Fac. Fisheries, Hokkaido Univ.	Geochemistry
Masashi KUSAKABE	Fac. Fisheries, Hokkaido Univ.	Geochemistry
Takayoshi SHINAGAWA	Fac. Fisheries, Hokkaido Univ.	Geochemistry
Megumu KAMBA	Fac. Fisheries, Hokkaido Univ.	Biology
Satoshi NISHIZAWA	Fac. Agr. Sci., Tohoku Univ.	Biological Oceanography
Toshihiro ICHIKAWA	Fac. Agr. Sci., Tohoku Univ.	Biological Oceanography
Kazuo ISEKI	Fac. Agr. Sci., Tohoku Univ.	Biological Oceanography
Yasuhiro SATOH	Fac. Sci., Yamagata Univ.	Geochemistry
Masaru MAYEDA	Tokyo Univ. of Fisheries	Geochemistry
Kenzo TAKANO	Inst. Phys. Chem. Res.	Physical Oceanography
Nobuhiko HANDA	Water Res. Inst., Nagoya Univ.	Chemistry
Katsuji MATSUNAGA	Water Res. Inst., Nagoya Univ.	Chemistry
Eiichiro TANOUE	Water Res. Inst., Nagoya Univ.	Chemistry
R. J. Barsdate	Inst. Marine Sci., Univ. of ALASKA	Geochemistry
J. J. Goering	Inst. Marine Sci., Univ. of ALASKA	Biological Oceanography

Hydrographic observations

Nansen bottle casts were made to collect information for water temperature, salinity, concentration of dissolved oxygen, inorganic nutrients and others. Large volumes of water samples were simultaneously collected by van Dorn bottles (25 l), and chlorophyll content, mass of total seston, particulate carbon and nitrogen, and species composition of phytoplankton were determined. The names of the persons who conducted the measurements are given after each item.

Water temperature was measured by a pair of protected reversing thermometers. The sampling depths were estimated from wire lengths, wire angles and the differences between readings of protected and unprotected reversing thermometers (Nakai and Otobe). Salinity was determined using an Auto Lab 601 MK III inductive salinometer (Otobe, Iizumi, Koike, Saino and Kanba).

Dissolved oxygen was determined by the Winkler method (Maeda). pH was measured with a pH meter, and the alkalinity was estimated, according to Strickland and Parsons (1972), from the pH shift after the addition of a definite amount of HCl to sea water samples (Konishi, Ichikawa and Tsunogai).

Reactive silicate was determined by a modification of the method described in the Manual of Oceanographic Observations (Oceanographic Society of Japan, 1970) (Minagawa and Tsunogai); reactive phosphate by the method of Murphy and Riley (1962) (Kusakabe and Tsunogai); total phosphate by the method of Menzel and Corwin (1965) (Matsunaga). Nitrate was determined by a modification of the method of Wood, Armstrong and Richards (1967) (Shinagawa and Tsunogai); nitrite by the method of Bendschneider and Robinson (1952) (Koike, Saino and Iizumi); and ammonia by the method of Sagi (1966) as modified by Hattori and Wada (1971) (Koike, Saino and Iizumi) and by a modification of the method of Matsunaga and Nishimura (1974) (Shinagawa, Izeki and Tsunogai).

Particulate matter was collected on a Whatman type C glass fibre filter. Chlorophylls were determined by the spectrophotometric method and/or the fluorometric method as described by Strickland and Parsons (1972) (Tanoue and Handa), and C and N contents by a dry combustion technique using a Yanagimoto CHN analyzer (Handa, Matsunaga and Tanoue). Standing crops and species composition of phytoplankton were determined by direct counting under a microscope with aliquots of water samples treated with 5% formalin (Nemoto and Ishimaru).

The data available at present are tabulated in Tables 3 - 32, and cross sections of oceanographic parameters along 57°N are illustrated in Figs. 2 - 8.

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Table 3. Summary of hydrographic data at Station 2*

Date	Time	Lat.	Long.	Depth
Jun. 26-27, 1976	22:05-00:02	44°31.0'-44°32.1'N	151°01.0'-150°59.6'E	7700 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
rainy	9.0°C	E-14.0	1005.3	5	5	4	10

Dep. (m)	Temp. (°O)	Sal. (‰)	σ_t	$\triangle_{st}$ (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P		SiO_2-Si μg at/l		NO_2-N		NO_2-N	NH_4-N	NH_4-N)	**
0	7.9	32.921	25.68	232	7.166	7.285	106.8	108.6	-0.465	-0.574	8.292	8.273	2.274	2.276	1.10	1.06	1.57	1.43	39.5	45	9.3	9.6	0.12		1.9	2.0
10	7.78	952	72	228	7.393	7.368	109.9	109.5	-0.665	-0.640	280	276	279	276	0.97	1.03	1.43	1.40	39	40	8.7	9.9	26		2.6	3.7
30	3.25	33.053	26.33	170	7.533	7.532	100.5	100.5	-0.038	-0.037	107	103	263	263	1.77	1.70	1.93	1.91	51	-	19.8	21.6	40		2.7	2.7
51	1.99	127	50	155	7.444	7.409	95.7	95.8	0.330	0.325	083	086	279	279	1.88	1.84	2.12	1.97	53	53	22.2	21.0	72		2.7	2.9
76	1.25	224	63	142	6.872	6.864	87.2	87.1	1.006	1.014	022	025	270	265	2.12	2.16	2.26	2.14	56	61	-	26.7	16		3.5	2.2
101	1.38	331	70	135	5.954	5.947	75.9	75.8	891	1.898	7.924	7.938	286	282	2.33	2.34	2.52	2.40	73	64	24.6	25.4	17		1.8	2.0
152	1.69	487	81	125	4.521	4.512	58.1	58.0	3.250	3.262	824	829	296	298	2.62	2.68	3.03	2.81	83	79	26.2	26.5	15		1.3	-
202	2.38	682	91	116	3.049	3.065	40.0	40.0	4.580	4.564	727	737	311	313	2.84	2.95	2.89	2.95	99	95	30.2	-	06		2.3	0.9
253	2.48	761	76	110	2.469	2.430	32.5	32.0	5.137	5.116	685	690	328	330	3.10	3.07	3.07	3.10	106	98	32.0	32.1	22		1.7	-
303	2.49	841	27.02	104	2.205	2.168	29.0	28.5	5.395	5.431	657	659	351	354	2.91	2.93	3.03	3.00	109	111	34.6	33.2	23		1.3	0.8
503	2.99	34.088	18	90	0.935	0.899	12.5	12.0	6.557	6.593	611	623	355	356	3.28	3.25	3.28	3.33	128	136	41.1	41.1	02		0.3	
706	3.10	298	34	75	1.004	0.993	13.4	13.3	6.457	6.468	649	656	375	377	3.19	3.18	3.22	3.18	138	141	42.8	43.0	03		1.3	-
897	2.64	358	43	66	0.805	0.852	10.7	11.3	6.740	6.693	651	653	392	402	3.10	3.15	3.40	3.32	155	153	38.1	37.6	05		1.2	0.3
1081	2.45	431	50	59	1.003	0.999	13.2	13.2	6.574	6.578	655	661	409	407	2.97	2.98	2.99	2.97	150	-	38.2	38.9	01		1.2	-
1254	2.25	458	54	56	1.134	1.130	14.9	14.9	6.480	6.485	651	661	406	403	3.25	3.17	3.29	3.17	169	164	39.1	38.9	03		0.0	0.3
1392	2.12	469	56	54	1.343	1.322	17.6	17.3	6.296	6.317	676	678	417	418	3.26	3.15	3.28	3.13	167	167	37.2	38.4	03		0.0	0.3

* Water samples were collected by Nansen bottles.

Table 4. Summary of hydrographic data at Station 4*

Date	Time	Lat.	Long.	Depth
Jun. 29, 1975	01:31-03:35	49°30.7'-49°32.4'N	158°03.5'-158°01.8'E	6500 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
clear	5.8°C	E-3.0	1014.5	2	3	8	1

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P		SiO_2-Si μg at/l		NO_2-N		NO_2-N	NH_4-N	NH_4-N)	ox
0	5.9	32.508	25.62	238	8.070	8.103	114.5	114.9	-1.020	-1.052	8.322	8.325	2.248	2.250	0.18	0.21	0.69	0.73	23	12	3.6	3.7	0.02	0.5	0.5	0.9
10	5.82	498	62	238	8.095	8.101	114.6	114.7	-1.030	-1.036	325	327	261	260	0.20	0.19	0.86	0.70	16	22	0.2	0.1	05	1.6	0.6	0.9
30	0.82	727	26.25	178	8.318	8.351	104.1	104.5	-0.324	-0.357	305	310	272	270	1.01	1.00	1.49	1.53	14	12	10.5	9.8	10	4.2	0.5	1.0
49	-0.44	870	43	161	7.982	7.976	96.7	96.6	0.276	0.282	192	185	270	272	1.67	1.62	1.69	1.77	37	47	19.4	19.5	13	3.9	3.6	1.0
74	-0.55	953	50	154	7.680	7.719	92.8	93.3	597	558	100	100	268	271	1.96	1.97	2.07	2.07	54	49	25.5	25.4	17	3.0	2.0	2.9
99	-0.24	33.045	56	148	7.455	7.497	90.9	91.4	748	706	051	039	273	270	2.13	2.15	2.04	2.25	65	60	27.2	27.0	21	1.4	3.7	3.2
148	0.02	123	61	144	7.246	7.263	89.0	89.2	897	879	024	025	274	272	2.31	2.29	2.30	2.33	78	66	30.2	29.8	19	0.5	0.8	0.6
197	0.39	155	62	143	6.996	7.002	86.8	86.9	1.065	1.058	003	000	279	277	2.33	2.33	2.32	2.37	67	85	30.6	30.3	08	4	1.9	1.7
247	1.46	385	74	132	5.290	5.314	67.6	67.9	2.536	2.513	7.861	7.855	280	279	2.67	2.62	2.60	2.63	79	76	33.0	33.9	14	4	0.3	0.0
296	2.85	657	85	121	2.896	2.894	38.4	38.4	4.644	4.646	719	710	302	300	2.98	2.90	2.97	3.01	97	86	39.8	39.9	09	4	5	0
493	3.44	34.053	27.11	96	0.761	0.786	10.3	10.6	6.649	6.624	572	561	348	346	3.52	3.41	3.40	3.39	129	118	45.2	45.4	03	4	5	4
690	3.25	216	26	82	477	474	6.4	6.4	6.960	6.963	584	567	385	382	3.54	3.54	3.35	3.51	153	134	44.9	45.1	04	4	5	0
887	2.98	317	36	72	433	418	5.8	5.6	7.049	6.065	576	566	402	398	3.47	3.47	3.38	3.41	-	154	43.6	43.9	01	4	5	0
1085	2.71	367	43	66	635	619	8.4	8.2	6.896	6.912	602	598	406	407	3.43	3.43	3.24	3.25	163	153	42.1	42.6	03	4	0	0
1282	2.50	447	51	59	644	612	8.5	8.1	6.923	6.955	605	598	416	415	3.48	3.44	3.26	3.44	171	167	45.6	44.7	05	6.8	0	0
1479	2.28	504	57	53	863	866	11.3	11.4	6.743	6.740	612	611	422	424	3.48	3.45	3.24	3.31	179	167	41.9	43.8	03	0.5	0	0

* Water samples were collected by Nansen bottles.

Table 5. Summary of hydrographic data at Station 5*

Date	Time	Lat.	Long.	Depth
Jun. 30, 1975	06:25-08:15	52°00.1'-52°00.4'N	162°00.8'-162°00.7'E	5800 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
fog	6.4°C	SW-13.0	1006.6	4	3	1	10

Dep. (m)	Temp. (°O)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P		SiO_2-Si μg at/l		NO_3-N		NO_2-N	NH_4-N	NH_4-N) ex
0	7.1	33.106	25.94	208	7.385	7.375	108.2	108.0	-0.557	-0.547	8.230	8.231	2.249	2.255	1.06	1.17	1.49	1.53	21	23	16.1	15.4	0.00	1.0	1.0 1.4
10	7.00	096	94	207	7.492	7.461	109.5	109.0	-0.648	-0.617	235	231	252	254	1.17	1.16	1.72	1.53	22	22	15.2	15.0	17	0.9	1.5 1.1
30	4.18	107	26.29	175	7.740	7.718	105.7	105.4	-0.419	-0.396	244	235	274	279	1.20	1.17	1.53	1.53	17	16	16.1	15.5	18	1.8	2.3 2.2
50	1.49	140	54	150	7.622	7.591	97.3	96.9	0.211	0.243	088	073	275	282	2.07	2.04	2.11	2.12	48	48	25.8	25.8	30	2.0	2.5 2.7
75	1.21	172	59	146	7.554	7.534	95.8	95.5	0.334	0.355	051	053	280	282	2.21	1.92	2.24	2.11	53	51	28.1	28.1	31	1.0	1.2 1.7
99	0.87	203	63	142	7.333	7.320	92.2	92.0	0.624	0.637	023	028	286	288	2.25	2.20	2.25	2.21	53	55	29.9	30.2	07	0.4	0.3 0.5
149	2.03	470	77	129	4.637	4.616	60.2	59.9	3.071	3.092	7.828	7.826	299	302	2.69	2.74	2.64	2.68	68	72	36.8	36.5	06	4	3 2
199	3.44	853	95	111	1.305	1.283	17.6	17.3	6.115	6.137	609	607	325	328	3.36	3.38	3.23	3.13	99	99	46.2	45.3	08	4	4 7
249	3.48	953	27.03	104	0.853	0.772	11.5	10.4	6.554	6.636	626	611	344	348	3.27	3.29	3.16	3.15	107	106	46.9	46.2	04	4	7 3
298	3.45	34.023	09	99	674	651	9.1	8.8	6.735	6.758	586	578	359	359	3.34	3.12	3.21	3.31	114	113	45.3	45.9	02	3	1.4 0
497	3.28	200**	24**	84**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	02	-	- -
696	2.98	319	37	72	0.406	0.385	5.4	5.2	7.076	7.097	7.612	7.597	2.400	2.397	3.38	3.39	3.23	3.20	146	145	44.7	44.5	00	0.3	0.7 0.7
905	2.70	405	46	63	485	472	6.4	6.3	7.046	7.059	615	595	414	411	3.38	3.38	3.23	3.29	157	157	44.9	45.7	01	6	4 6
1093	2.46	464	53	57	855	583**	11.3	7.7**	6.718	6.990**	632	623	425	421	3.20	3.21	3.09	-	165	165	45.0	44.7	04	4	0 6
1292	2.26	512	58	52	820	810	10.8	10.6	6.790	6.800	645	638	424	426	3.26	3.25	3.07	3.07	174	173	44.9	-	02	5	1.2 1.2
1491	2.09	549	63	48	1.103	1.108	14.4	14.5	6.538	6.533	660	651	446	440	3.25	3.07	3.07	3.07	175	175	43.4	43.7	01	7	0.2 0.6

* Water samples were collected by Nansen bottles.
** Values interpolated.

Table 6. Summary of hydrographic data at Station 6*

Date	Time	Lat.	Long.	Depth
Jul. 1, 1975	07:06–11:02	54°30.4'–54°31.3'N	164°25.0'–164°26.6'E	4800 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
clear	10.5°C	NNW-5.5	1011.3	2	3	8	2

Dep. (m)	Temp. (°O)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_2-N		NO_2-N	NH_4-N	NH_4-N)	ox
0	7.5	33.058	25.84	217	7.287	7.256	107.7	107.2	-0.520	-0.490	8.190	8.182	2.257	2.257	1.36	1.32	1.83	16	12	16.0	15.1	0.26	0.7	0.5	0.4
10	6.31	056	26.00	202	7.684	7.678	110.4	110.4	-0.727	-0.720	212	198	261	258	1.39	1.42	1.76	27	19	15.2	2	26	1.1	6	4
30	4.52	077	23	180	7.586	7.590	104.5	104.5	-0.324	-0.328	161	145	262	261	1.74	1.65	2.03	32	32	18.9	19.2	31	2.0	1.0	6
50	2.36	134	47	157	7.268	-	94.9	-	0.393	-	045	050	267	266	2.19	2.19	2.32	59	58	26.1	26.0	38	2.3	1.6	5
75	2.01	172	53	151	7.276	7.269	94.2	94.1	0.451	0.459	034	028	267	268	2.23	2.29	2.42	63	56	27.6	27.3	32	1.4	1.1	9
100	1.92	280	62	143	6.441	6.398	83.2	82.7	1.299	1.341	7.970	7.971	269	269	2.49	2.51	2.79	61	67	30.7	31.3	10	0.8	1.4	3
149	3.51	685	81	125	2.633	2.635	35.5	35.5	4.782	4.780	711	715	298	294	3.18	3.30	3.17	86	87	39.5	39.2	08	4	0.1	4
199	3.71	850	92	114	1.344	1.340	18.2	18.2	6.026	6.031	600	609	311	309	36	35	29	95	97	43.2	43.7	04	6	4	0
249	3.69	905	97	110	0.965	0.981	13.1	13.3	6.406	6.390	586	605	318	320	35	37	35	108	107	44.7	45.1	06	5	1	0
299	3.67	994	27.04	103	-	-	-	-	-	-	578	592	334	333	51	49	41	109	109	45.6	44.9	02	5	0	0
498	3.26	34.151	21	87	0.596	0.574	8.0	7.7	6.842	6.864	601	595	360	361	51	54	47	130	125	45.3	45.3	09	4	0	0
698	3.11	284	33	76	477	473	6.4	6.4	6.982	6.986	634	622	382	382	47	58	45	143	143	45.2	-	01	8	1	0
897	2.88	363	41	68	477	456	6.4	6.1	7.022	7.043	608	613	391	391	54	54	53	155	154	44.6	45.0	00	6	0	1
1096	2.65	427	48	61	547	525	7.3	7.0	6.992	7.014	613	625	404	402	46	46	38	161	159	44.8	45.1	00	3	0	0
1296	2.40	478	54	55	626	622	8.3	8.2	6.958	6.962	609	615	410	405	46	46	41	173	170	44.7	42.6	02	6	0	0
1495	2.22	515	59	51	913	861	12.0	11.3	6.704	6.756	633	627	420	418	50	56	35	179	182	-	43.7	03	4	0	0
1534	2.18	534	61	50	721	924	12.1	12.1	6.703	6.700	635	633	418	420	42	37	29	175	175	44.2	43.7	03	5	0	1
1781	2.00	578	66	45	1.272	1.274	16.6	16.6	6.385	6.383	672	659	428	432	49	46	29	182	180	43.3	43.2	09	3	2	0
2028	1.86	606	69	42	1.617	1.619	21.1	21.1	6.065	6.064	702	698	438	435	44	38	22	177	179	41.6	40.9	07	5	2	0
2276	1.75	613	70	40	1.999	1.979	25.7	25.7	5.705	5.725	730	721	436	438	29	26	11	175	179	42.1	41.1	05	1.6	0	0
2524	1.68	645	73	37	2.285	2.291	29.7	29.7	5.432	5.426	754	756	440	442	27	24	11	170	173	39.7	40.0	07	0.3	1	1
2771	1.62	652	74	36	2.592	2.580	33.4	33.4	5.135	5.148	782	764	444	449	15	10	09	170	170	39.5	39.1	05	6	0	0
3019	1.58	662	75	35	2.840	2.813	36.4	36.4	4.896	4.922	810	800	450	449	00	2.96	05	163	161	38.5	38.4	00	4	0	4
3267	1.55	675	77	34	2.989	3.001	38.8	38.8	4.751	4.740	814	805	448	450	00	3.00	2.91	163	159	38.2	37.8	08	1.1	1	1
3515	1.53	681	77	34	3.164	3.152	40.7	40.7	4.580	4.592	838	806	438	440	03	2.91	92	158	158	37.7	37.6	03	0.4	1	1
3763	1.52	682	78	34	3.299	3.262	42.1	42.1	4.447	4.484	873	836	453	455	2.68	87	68	156	155	38.2	37.7	12	7	1	8
4011	1.49	688	78	33	3.374	3.347	43.2	43.2	4.378	4.405	868	842	452	443	84	74	69	156	155	36.1	36.4	04	-	2	2
4260	1.50	691	78	33	3.497	3.496	45.1	45.1	4.252	4.254	855	828	441	445	91	95	83	158	152	37.2	37.7	03	0.6	0	1
4508	1.49	690	78	33	3.578	3.579	46.2	46.2	4.173	4.172	864	825	453	453	82	93	80	152	150	36.8	36.9	06	4	0	2
4757	1.49	691	78	33	3.512	3.513	45.3	45.3	4.240	4.239	904	900	471	468	60	61	57	-	149	35.9	35.1	00	-	5	1.5

* Water samples were collected by Nansen bottles.

Table 7. Summary of hydrographic data at Station 7*

Date	Time	Lat.	Long.	Depth
Jul. 3, 1975	10:00-13:25	56°57.5'-56°58.1'N	167°07.5'-167°08.3'E	3800 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
cloudy,	11.2	NW-5.0	1006.3	1	2	7	8
fine	15.2	calm	1006.9				7

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_2-N		NO_3-N	NH_4-N	NH_4-N)	ox
0	7.9	32.878	25.65	235	7.364	7.318	109.7	109.0	-0.652	-0.606	8.362	8.371	2.275	2.276	0.70	0.80	1.12	28	54	3.1	3.4	0.04	1.4	2.1	2.7
10	6.53	884	84	217	7.557	7.584	100.1	109.4	-0.627	-0.654	379	392	276	274	0.62	0.69	1.11	34	38	3.1	3.1	05	1.8	0.4	8
30	-0.18	907	26.45	159	8.251	8.220	100.7	100.3	-0.053	-0.022	263	275	272	275	1.47	1.30	1.69	27	47	12.7	12.7	12	6.6	5.1	1.4
50	-0.57	969	52	153	7.973	7.959	96.3	96.1	0.308	0.321	181	195	271	-	1.86	1.87	1.95	58	45	19.2	19.0	13	5.4	1.1	0.7
75	-0.43	33.056	58	147	7.719	7.704	93.6	93.4	526	541	082	097	275	277	2.16	2.06	2.22	60	95	24.3	24.5	22	2.9	1.9	3.6
99	-0.11	105	61	144	7.521	7.512	92.0	91.9	651	660	055	088	279	279	2.24	2.31	2.28	58	63	27.1	27.4	17	1.0	0.0	0.0
149	-0.02	146	64	141	7.451	7.431	91.4	91.2	699	718	041	060	289	291	2.36	2.36	2.36	70	73	27.9	28.0	09	0.5	0	4
199	0.37	195	66	140	7.160	7.149	88.8	88.7	903	914	033	037	293	284	2.22	2.38	2.32	71	67	29.3	29.3	05	4	3	7
248	1.52	358	72	134	5.558	5.573	71.1	71.3	2.258	2.243	7.898	7.939	302	298	2.48	2.62	2.61	78	76	34.3	33.7	07	4	0	2
298	2.69	590	81	125	3.430	3.427	45.3	45.3	4.144	4.146	787	801	316	317	2.86	3.06	2.81	99	96	38.6	39.0	05	5	5	1.1
497	3.46	34.010	27.08	100	0.797	0.784	10.8	10.6	6.611	6.625	602	607	345	339	3.63	3.65	3.36	126	132	-	43.1	06	4	5	0.0
695	3.31	190	23	85	447	442	6.0	6.0	6.980	6.985	605	601	372	369	3.53	3.57	3.38	161	161	45.7	45.6	04	4	8	1
894	3.01	305	35	74	390	404	5.2	5.4	7.087	7.073	622	589	378	374	3.68	3.66	3.42	165	162	46.5	46.2	00	3	2	4
1093	2.76	387	44	65	417	389	5.6	5.2	7.103	7.132	613	605	402	398	3.53	3.45	3.32	184	192	46.3	45.7	01	4	0	8
1291	2.52	454	51	58	492	488	6.5	6.5	7.071	7.074	609	602	407	392	3.54	3.56	3.38	191	189	44.9	45.9	00	2	0	7
1490	2.29	500	57	53	693	668	9.1	8.8	6.911	6.936	627	629	416	410	3.57	3.69	3.40	199	216	44.9	45.1	00	3	0	0
1522	2.26	501	57	53	693	817**	9.1	10.7	6.917	6.794	641	639	419	419	3.61	3.69	3.36	186	185	-	42.3	01	3	0	0
1766	2.06	550**	63	47	1.085	1.080	14.2	14.1	6.565	6.570	656	662	431	422	3.62	3.54	3.31	189	192	40.1	40.0	02	8	0	0
2011	1.90	589	67	43	1.260	1.273	16.4	16.6	6.415	6.403	703	692	443	437	3.62	3.67	3.20	-	-	39.8	40.3	03	5	7	1.2
2256	1.80	612	70	41	1.521	1.518	19.8	19.7	6.173	6.176	724	702	449	446	3.63	3.70	3.24	205	208	38.5	39.1	02	1.1	1.1	-
2502	1.73	631	72	39	1.712	1.718	22.2	22.3	5.995	5.984	751	741	453	448	3.56	3.62	3.25	210	204	38.9	37.7	02	0.5	0.9	-
2748	1.67	643	73	38	2.028	1.894	26.3	24.5	5.691	5.825	763	771	451	446	3.57	3.44	3.34	213	214	38.1	37.9	03	4	9	0.5
2993	1.64	655	74	36	2.101	2.103	27.2	27.2	5.623	5.621	783	788	449	449	3.44	3.37	3.07	217	215	37.2	37.5	03	4	0	0
3239	1.61	662	75	36	2.260	2.247	29.2	29.1	5.469	5.482	789	792	451	456	3.38	3.32	3.01	211	210	37.4	-	06	5	0	1.3
3485	1.59	679	77	34	2.521	2.522	32.6	32.6	5.211	5.210	799	800	454	457	3.34	3.23	2.93	198	196	-	36.8	03	5	-	-
3730	1.53	680	77	34	3.021	2.992	39.0	38.6	4.723	4.753	876	888	465	466	3.09	2.95	2.77	175	175	36.7	36.1	07	5	-	-

* Water samples were collected by Nansen bottles.
** Values interpolated.

Table 8. Summary of hydrographic data at Station 8*

Date	Time	Lat.	Long.	Depth
Jul. 5, 1975	03:47-05:00	57°00.1'-57°00.4'N	171°00.4'-170°59.5'E	1900 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
overcast	5.2°C	ENE-4.3	1018.9	3	3	7	9

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_3-N		NO_2-N	NH_4-N		NH_4-N) ox	
0	6.3	32.832	25.83	218	7.181	7.193	103.0	103.2	-0.212	-0.224	8.308	8.305	2.253	2.253	0.90	0.90	1.31	19	20	4.9	4.5	0.06	2.4	3.0	3.0	1.2
10	5.72	799	87	214	7.301	7.329	103.3	103.7	-0.234	-0.262	304	328	256	262	0.87	0.84	1.20	17	12	4.3	4.3	07	3.6	2.5	0.4	0.5
29	0.29	962	26.47	157	8.024	7.993	99.1	98.8	0.069	0.100	212	228	262	268	1.53	1.55	1.86	40	38	14.3	14.3	10	5.1	4.8	2	2
49	0.16	33.036	54	151	7.946	7.928	97.9	97.7	171	189	177	192	265	267	1.73	1.72	1.98	44	37	16.5	16.7	11	4.3	4.0	5	2
73	0.10	108	60	145	7.637	7.623	94.0	93.8	489	502	099	165	264	272	2.04	2.04	2.05	61	49	21.9	21.8	18	3.2	3.1	3	2
97	0.09	136	62	143	7.506	7.482	92.4	92.1	621	644	079	078	267	276	2.09	2.11	2.25	53	57	24.8	24.8	24	2.1	2.2	5	3
146	0.13	169	65	140	7.437	7.432	91.6	91.6	679	684	029	059	272	277	2.24	2.24	2.34	70	63	27.5	27.0	04	0.3	0.6	2.1	7
194	0.59	224	67	139	6.971	6.958	87.0	86.8	1.044	1.057	012	017	276	281	2.26	2.25	2.33	63	62	28.1	28.5	04	5	5	2.2	1.9
242	2.74	525	75	130	3.891	3.894	51.4	51.5	3.676	3.674	7.803	7.804	294	297	2.73	2.67	2.79	88	87	36.5	36.0	05	6	3	1.5	2.1
290	3.25	661	82	124	2.817	2.809	37.7	37.6	4.648	4.655	725	753	317	313	2.85	2.83	2.87	90	90	38.2	38.2	05	6	2	0.0	0.0
480	3.46	34.023	27.09	99	0.888	0.855	12.0	11.5	6.520	6.553	602	595	347	351	3.32	3.33	3.36	117	116	43.6	44.4	03	6	3	4	3
671	3.31	199	24	84	499	468	6.7	6.3	6.928	958	591	599	377	373	3.32	3.35	3.40	134	131	44.6	44.5	02	4	3	2	9
864	3.04	293	34	75	424	430	5.7	5.8	7.048	7.042	582	596	386	387	3.43	3.40	3.42	147	145	44.2	44.5	00	9	3	1.5	3
1058	2.08	382	43	66	472	468	6.3	6.2	7.041	7.044	608	611	402	395	3.34	3.30	3.35	157	155	43.9	44.3	01	4	2	0.1	4
1255	2.51	450	51	58	556	582	7.4	7.7	7.008	6.983	614	629	417	418	3.36	3.37	3.35	172	171	43.9	43.5	01	6	2	1.4	8
1454	2.30	493	56	54	731	698	9.6	9.2	6.872	6.905	638	637	418	420	3.20	3.28	3.33	182	189	42.7	43.4	02	9	3	0.1	0
1703	2.08	534	61	49	953	935	12.5	12.2	6.690	6.709	644	641	421	432	3.40	3.35	3.33	198	197	42.0	41.7	01	3	2	0	0

* Water samples were collected by Nansen bottles.

Table 9. Summary of hydrographic data at Station 9*

Date	Time	Lat.	Long.	Depth
Jul. 6, 1975	00:10-03:49	56°59.9'-59°59.7'N	174°58.7'-174°55.9'E	3820 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
cloudy	5.1	NNE-10.0	1016.9	3	3	6	8
fog	4.8	NNE- 8.0	1016.3			4	10

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P		SiO_2-Si μg at/l		NO_2-N		NO_3-N	NH_4-N	NH_4-N) ox
0	5.7	33.168	26.17	186	7.290	7.234	103.4	102.6	-0.236	-0.181	8.233	8.233	2.285	-	1.86	1.77	1.96		48	43	24.2	21.8	0.25	0.7	0.9	0.9
10	5.66	163	17	186	7.308	7.292	103.5	103.4	-0.247	-0.237	162	147	286	2.284	1.84	1.80	1.96		38	41	22.0	21.0	25	8	5	8
29	5.53	168	19	184	7.386	7.347	104.3	103.7	-0.303	-0.264	134	166	292	301	1.78	1.71	1.91		38	41	23.7	20.9	25	8	1.2	1.0
49	2.40	232	55	150	7.847	7.848	102.6	102.6	-0.199	-0.200	122	110	288	295	1.98	2.01	2.08		63	51	24.4	24.0	32	8	0.7	1.6
73	1.91	226	58	147	7.572	7.587	97.8	98.0	0.172	0.158	056	067	275	277	2.11	2.25	2.05		65	57	26.0	26.0	40	9	1.2	0.7
97	1.72	228	60	145	7.655	7.630	98.4	98.1	127	152	061	075	274	273	2.22	2.21	2.17		62	59	25.3	25.3	36	1.4	1.1	8
146	1.27	229	63	142	7.363	7.349	93.5	93.3	510	525	020	014	283	-	2.30	2.35	2.28		67	63	28.2	27.9	05	0.2	0.5	1
195	0.81	224	65	140	7.286	7.306	91.4	91.7	682	662	020	010	275	275	2.21	2.24	2.26		57	58	27.8	28.4	04	4	8	3
243	3.43	646	79	127	2.833	2.847	38.1	38.3	4.599	4.585	7.764	7.771	300	301	2.95	2.90	2.82		88	89	39.6	39.1	06	4	-	-
292	3.69	799	89	118	1.695	1.692	23.0	22.9	5.681	5.684	675	661	319	321	3.10	3.10	3.05		99	101	42.2	42.6	05	3	0.1	0.2
490	3.43	34.080	27.13	94	0.702	0.698	9.5	9.4	6.728	6.731	612	596	345	351	3.41	3.43	3.30		125	126	44.3	44.5	03	2	3	1
687	3.25	230	27	81	500	519	6.7	7.0	6.937	6.917	594	580	380	376	3.48	3.45	3.27		152	141	45.5	45.1	03	2	1	1
881	2.98	327	37	72	439	435	5.9	5.8	7.043	7.047	599	591	384	382	3.47	3.47	3.29		155	152	45.2	44.2	01	2	0	0
1085	2.73	400	45	64	517	496	6.9	6.6	7.008	7.029	624	588	408	409	3.42	3.44	3.23		162	162	45.7	45.5	02	4	1	0
1284	2.46	457	52	58	583	580	7.7	7.7	6.991	6.993	625	603	417	419	3.44	3.45	3.27		176	178	44.8	44.8	01	2	1	0
1482	2.26	507	58	52	723	728	9.5	9.6	6.887	6.882	654	620	425	428	3.50	3.37	3.28		188	187	44.8	44.4	02	2	1	2
1504	2.25	509	58	52	777	774	10.2	10.2	6.835	6.837	632	633	430	428	3.49	3.45	3.28		187	186	44.6	44.0	01	2	-	-
1746	2.05	557	64	47	999	1.001	13.1	13.1	6.649	6.647	658	662	462	450	-	3.34	3.24		198	195	43.7	43.9	02	3	0	5
1987	1.89	593	68	43	1.241	1.234	16.2	16.1	6.436	6.444	677	687	451	442	3.38	3.42	3.22		209	214	40.9	41.9	03	1	6	7
2229	1.78	614	70	41	1.480	1.434	19.2	19.3	6.218	6.214	698	698	446	452	3.48	3.38	3.12		-	211	42.5	41.6	03	6	1	2
2470	1.71	637	73	38	1.724	1.688	22.4	21.9	5.986	6.022	712	745	461	463	2.61	3.35	3.15		218	218	40.2	39.5	04	4	2	4
2713	1.65	647	74	37	1.858	1.847	24.1	23.9	5.864	5.875	736	641	472	471	3.27	3.34	3.06		240	224	39.8	40.6	04	5	7	4
2954	1.62	655**	75	36	2.064	2.058	26.7	26.6	5.663	5.668	661	658	474	480	3.28	3.26	2.95		225	226	40.4	39.8	03	4	0	1
3196	1.61	665	76	35	2.207	2.178	28.6	28.2	5.522	5.551	758	751	478	475	3.21	3.20	2.97		223	225	39.3	39.2	06	7	3	3
3439	1.60	667	76	35	2.245	2.255	29.0	29.2	5.486	5.476	750	749	466	472	3.19	3.24	2.95		227	232	38.8	38.6	01	3	3	3
3682	1.61	670	76	35	2.363	2.369	30.6	30.7	5.366	5.360	775	773	486	488	3.09	3.17	2.93		233	232	38.2	39.0	02	2	4	4

* Water samples were collected by Nansen bottles.
** Values interpolated.

Table 10. Summary of hydrographic data at Station 10*

Date	Time	Lat.	Long.	Depth
Jul. 7, 1975	01:05-05:57	57°00.7'-57°00.6'N	178°59.9'-179°02.0'E	3835 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
rainy	5.3	ESE-8.0	1007.0	3	4	6	10
overcast		E -6.5	1006.4			7	

Dep. (m)	Temp. (°O)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_3-N		NO_2-N	NH_4-N	NH_4-N) ox
0	5.5	32.948	26.02	200	7.405	7.401	104.2	104.3	-0.307	-0.303	8.221	8.212	2.246	2.248	1.61	1.58	1.74	63	56	18.7	18.4	0.20	0.9	- 0.4
10	5.50	943	01	201	7.449	7.449	104.9	104.9	-0.350	-0.351	203	201	247	251	55	54	84	56	48	17.8	17.9	21	1.0	0.4 0
30	4.99	33.089	19	184	7.539	7.543	105.0	105.1	-0.360	-0.364	190	185	267	264	59	54	77	40	39	19.6	19.8	22	1.1	4 1
49	2.33	215	54	150	7.918	7.899	103.3	103.1	-0.255	-0.236	147	160	278	265	97	91	2.16	-	49	23.6	23.5	30	1.2	7 5
74	1.80	222	59	146	7.651	7.668	98.5	98.7	0.115	0.098	111	112	264	266	2.06	2.09	17	-	59	25.1	25.0	35	1.9	7 6
99	1.53	217	60	145	7.506	7.476	96.0	95.6	315	345	072	080	274	269	13	12	19	62	66	28.4	26.2	30	1.3	0 2
148	1.07	219	63	142	7.401	7.399	93.5	93.5	514	516	067	066	272	271	17	23	26	74	69	27.9	27.7	14	0.5	0 0
197	0.85	222	65	140	7.332	7.332	92.1	92.1	629	628	063	068	280	277	18	13	26	66	65	27.8	28.3	00+	6	0 0
247	2.34	421	71	135	5.070	5.409	66.3	66.0	2.580	2.601	7.881	7.878	293	288	50	53	54	82	85	32.8	32.9	03	7	0 0
296	3.35	631	78	127	2.998	3.019	40.3	40.5	4.449	4.428	763	773	318	304	86	82	89	96	97	36.6	37.2	00+	4	0 0
493	3.48	994	27.06	101	1.012	1.005	13.7	13.6	6.394	6.400	628	632	340	337	3.27	3.38	3.24	119	-	42.9	43.0	00+	5	0 0
691	3.38	34.161	20	88	0.535	0.545	7.2	7.3	6.888	6.871	606	603	365	359	29	29	38	138	131	44.5	44.7	00+	4	0 0
888	3.07	290	33	75	429	424	5.7	5.7	7.038	7.042	611	607	378	381	33	28	27	153	148	44.9	44.5	00	3	0 0
1085	2.79	375	43	66	484	456	6.4	6.1	7.031	7.059	620	615	393	393	23	24	23	161	167	44.4	45.0	01	6	0 0
1282	2.54	442	50	59	525	507	6.9	6.7	7.035	7.053	637	631	398	413	28	23	27	181	173	43.9	44.3	00	4	0 0
1480	2.32	496	56	54	694	684	9.1	9.0	6.905	6.914	642	640	411	419	35	31	24	186	183	43.4	43.5	01	3	0 0
1490	2.32	502	56	53	707	694	9.3	9.1	6.892	6.905	641	641	408	419	31	31	24	196	207	43.6	43.2	00	4	0 1
1738	2.11	546	62	48	925	924	12.1	12.1	6.712	6.713	657	674	419	429	24	22	20	194	210	43.1	42.1	01	4	0 0
1974	1.94	584	67	44	1.356	1.310	17.7	17.1	6.313	6.358	709	705	440	335	21	28	17	208	209	41.6	41.3	00	4	0 0
2228	1.83	609	69	41	1.437	1.440	18.7	18.7	6.251	6.248	717	712	445	441	22	27	14	-	214	40.5	41.0	00	5	0 0
2472	1.74	639	72	38	1.618	1.587	21.0	20.6	6.087	6.118	729	723	443	440	16	20	09	219	219	40.8	41.2	01	4	0 0
2714	1.68	643	73	38	1.804	1.789	23.4	23.2	5.913	5.928	743	743	472	472	07	18	09	224	219	40.9	40.3	01	6	0 0
3191	1.62	662	75	36	2.105	2.068	27.2	26.8	5.623	5.659	779	769	460	466	00	04	02	245	222	39.1	39.1	02	5	0 0
3435	1.61	673	76	35	2.219	2.204	28.7	28.5	5.509	5.525	779	774	475	479	05	08	2.99	233	231	38.5	37.8	01	5	0 2
3679	1.62	680	77	34	2.175	2.154	28.2	27.9	5.551	5.573	835	831	492	496	2.93	-	86	243	238	38.3	38.4	00	4	2 0

* Water samples were collected by Nansen bottles.

Table 11. Summary of hydrographic data at Station 11*

Date	Time	Lat.	Long.	Depth
Jul. 7', 1975	04:05-07:13	57°02.6'-57°03.2'N	176°57.8'-176°56.9'W	3650 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
drizzle	6.5	SSW-10.0	1015.1	3	4	5	10
fog	5.8	SSW-12.5	1016.5	4		2	

Dep. (m)	Temp. (°O)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_2-N		NO_2-N	NH_4-N	NH_4-N)	ox
0	5.6	32.528	25.67	233	7.763	7.735	109.3	108.9	-0.662	-0.635	8.372	8.370	2.241	2.245	0.61	0.65	1.19	25	25	6.7	6.0	0.17	1.0	-	1.5
10	5.52	540	69	231	7.819	7.819	109.9	109.9	-0.705	-0.705	369	378	259	264	0.60	0.57	1.07	15	18	5.4	5.5	17	0.7	1.5	1.5
30	2.90	823	26.18	165	7.419	7.408	98.0	97.8	0.154	0.165	152	154	260	263	1.83	1.78	1.81	60	62	21.3	21.7	29	2.2	1.8	2.9
49	2.42	884	27	176	7.511	7.547	98.0	98.5	151	115	106	111	259	263	1.88	1.86	1.87	64	61	23.3	23.4	44	0.9	2.1	1.9
74	2.09	940	34	170	7.304	7.284	94.6	94.3	420	440	061	074	257	265	2.01	2.00	1.95	62	65	25.8	25.2	38	3	0.8	1.2
99	2.13	33.002	38	165	7.082	7.123	91.8	92.4	631	590	055	077	264	268	2.09	2.09	2.05	74	71	-	27.1	04	3	0	0.5
148	2.43	117	46	159	6.645	6.633	86.9	86.7	1.003	1.015	023	033	281	279	2.21	2.02	2.20	73	75	28.0	28.4	03	2	6	6
197	2.56	222	53	152	6.477	6.492	85.0	85.2	1.141	1.126	020	041	290	286	2.24	2.28	2.24	71	74	29.2	29.4	02	4	0	3
246	2.50	292	59	146	6.008	5.994	78.8	78.6	1.618	1.631	7.994	7.999	307	307	2.30	2.24	2.28	73	77	30.6	29.8	04	2	1	4
296	3.19	479	68	137	4.209	4.073	56.2	54.4	3.276	3.412	902	879	319	316	2.48	2.58	2.51	90	93	34.6	34.3	03	3	9	6
493	3.45	913	27.00	107	1.682	1.669	22.7	22.5	5.733	5.746	696	696	341	345	3.14	3.09	3.04	123	122	42.0	42.2	01	2	2	6
690	3.29	34.162	21	87	0.641	0.663	8.6	8.9	6.791	6.769	618	643	392	393	3.34	3.32	3.20	145	159	44.5	44.7	03	1	1	7
887	3.01	295	34	74	494	482	6.6	6.4	6.984	6.996	611	633	400	404	3.40	3.35	3.25	158	164	45.4	45.4	03	2	0	2
1084	2.72	383	44	65	494	526	6.6	7.0	7.034	7.002	615	634	422	421	3.29	3.32	3.14	175	173	44.8	44.7	03	2	1	3
1281	2.49	450	51	58	712	710	9.4	9.4	6.856	6.859	654	643	431	435	3.38	3.32	3.20	183	184	44.4	43.9	01	1	8	1
1478	2.26	505	58	52	766	768	10.1	10.1	6.844	6.842	668	668	433	430	3.35	3.38	3.22	202	194	44.5	44.2	01	2	1.2	4
1441	2.31	499**	57	53	743	735	9.8	9.7	6.858	6.866	650	670	427	432	3.40	3.29	3.17	192	192	45.0	44.6	02	6	0.1	1
1681	2.06	546	63	48	1.006	1.012	13.2	13.2	6.641	6.635	653	685	453	449	3.34	3.28	3.16	216	214	42.9	43.2	02	1.7	3	8
1922	1.92	577	66	44	1.194	1.179	15.6	15.4	6.479	6.494	700	710	479	477	3.33	3.27	3.13	-	218	42.1	42.1	02	0.7	1	0
2162	1.79	603	69	41	1.458	1.472	18.9	19.1	6.239	6.224	737	735	483	485	3.25	3.27	3.13	227	237	41.2	40.9	01	4	0	0
2402	1.70	621	71	39	1.669	1.664	21.6	21.6	6.045	6.049	751	762	491	489	3.19	3.20	3.04	227	235	40.3	40.5	04	6	1.2	1
2642	1.66	641	73	38	1.787	1.800	23.2	23.3	5.933	5.921	767	765	484	485	3.35	3.23	3.05	231	242	39.9	39.8	02	2.4	0.3	4
2882	1.62	649	74	37	2.034	2.012	26.3	26.0	5.694	5.716	796	794	476	483	3.28	3.13	3.03	232	228	39.0	38.9	02	0.2	1.2	4
3123	1.62	666	76	35	2.207	2.181	28.6	28.2	5.520	5.546	804	800	479	-	3.24	3.10	2.94	235	224	38.6	38.6	01	3	0.2	5
3363	1.60	675**	76	35	2.273	2.239	29.4	29.0	5.457	5.492	824	825	497	497	3.15	3.07	2.94	241	235	38.3	38.0	01	8	5	2

* Water samples were collected by Nansen bottles.
** Values interpolated.

Table 12. Summary of hydrographic data at Station 12*

Date	Time	Lat.	Long.	Depth
Jul. 9, 1975	05:17-05:55	57°00.4'-57°00.6'N	172°28.7'-172°28.6'W	130 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
rainy	6.6	ESE-9.0	997.8	4	5	5	10

Dep. (m)	Temp. (°O)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_2-N		NO_3-N	NH_4-N	NH_4-N)	ox
0	5.4	32.473	25.65	235	7.465	7.465	104.6	104.6	-0.328	-0.328	8.339	8.331	2.239	2.238	1.06	1.86	1.29	6	7	7.4	7.1	0.17	3.7	3.2	1.9	2.9
10	5.42	493	67	234	7.481	7.488	104.9	105.0	-0.348	-0.355	321	320	244	244	0.97	0.96	1.21	6	7	7.0	6.8	19	3.2	3.3	3.5	2.5
20	5.41	499	67	233	7.654	7.481	107.3	104.9	-0.519	-0.347	249	253	241	246	1.01	1.00	1.15	7	8	6.8	-	17	3.6	-	3.7	2.0
29	5.18	513	71	229	7.392	7.460	103.1	104.0	-0.219	-0.287	250	245	249	254	1.06	1.07	1.31	5	6	7.1	6.8	17	3.7	-	3.9	2.9
38	3.38	526	90	211	7.454	7.432	99.4	99.1	0.043	0.065	193	209	241	243	1.53	1.54	1.67	23	21	11.5	11.7	23	4.8	5.1	4.4	5.4
47	2.50	567	26.01	201	7.333	7.302	95.7	95.3	330	360	112	133	236	234	1.91	1.88	1.92	37	36	17.9	18.0	32	3.1	3.2	5.4	3.7
56	2.16	602	07	196	7.426	7.394	96.1	95.7	302	334	114	121	238	237	1.95	1.93	1.99	40	43	19.0	19.4	30	2.9	2.9	1.9	4.0
66	2.04	662	12	190	7.017	7.037	90.6	90.8	732	711	076	088	239	246	1.96	1.95	2.05	46	45	22.2	22.2	25	2.0	2.0	0.4	3.0
75	2.04	726	17	185	6.733	6.731	86.9	86.9	1.011	1.014	090	066	250	253	-	2.18	2.12	53	52	24.0	24.7	16	2.0	1.3	0.2	1.6
85	2.10	755	19	184	6.738	6.556	87.2	84.8	0.994	1.176	084	051	258	257	1.97	2.07	2.11	54	57	24.4	24.8	14	1.6	1.7	0.5	0.6
94	2.10	752	19	184	6.584	6.632	85.2	85.8	1.148	1.100	037	042	253	256	2.15	2.20	2.19	55	55	24.4	24.2	14	1.3	1.4	0.8	1.1
112	2.12	753	19	184	6.596	6.557	85.4	84.9	1.132	1.170	032	026	263	263	2.24	2.22	2.25	54	55	24.2	24.6	13	1.3	1.2	1.4	1.0

* Water samples were collected by Nansen bottles.

Table 13. Summary of hydrographic data at Station 13*

Date	Time	Lat.	Long.	Depth
Jul. 9, 1975	22:58-23:16	56°59.5'-56°59.5'N	168°00.5'-168°00.5'W	81 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
drizzle	7.4	SE-10.0	1002.3	4	4	6	10

Dep. (m)	Temp. (°O)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_2-N		NO_3-N	NH_4-N	NH_4-N)	ox
0	5.3	31.960	25.26	272	7.693	7.642	107.2	106.5	-0.515	-0.464	8.335	8.356	2.223	2.220	0.26	0.25	0.58	15	17	0.2	0.2	0.03	0.5	0.9	1.0
10	5.17	989	30	269	7.664	7.652	106.5	106.3	-0.464	-0.452	358	347	221	223	23	22	56	17	17	1	1	02	5	1.5	1.0
20	5.11	989	30	268	7.722	7.677	107.1	106.5	-0.512	-0.466	351	356	223	224	23	25	63	18	13	2	0	03	5	1.3	0.9
30	3.05	916	45	254	8.066	8.206	106.3	108.1	-0.476	-0.616	248	266	225	223	33	33	95	16	34	1	1	03	5	0.3	0.8
40	0.85	32.020	69	232	7.232	7.252	90.1	90.4	0.794	0.774	131	134	234	231	1.38	1.33	1.64	28	36	6.2	6.9	10	6.1	7.2	6.3
50	0.79	025	69	231	7.282	7.195	90.6	89.5	757	843	137	129	235	235	41	38	70	31	44	8.0	8.1	10	5.8	6.5	7.4
60	0.77	024	69	231	7.222	7.228	89.8	89.9	820	815	125	128	251	251	45	45	68	27	37	8.7	8.5	10	5.7	7.1	7.1
70	0.76	039	71	230	7.125	7.156	88.6	89.0	918	887	114	122	256	251	50	49	70	34	28	9.1	8.7	10	5.8	2.2	2.6

* Water samples were collected by Nansen bottles.

Table 14. Summary of hydrographic data at Station 14*

Date	Time	Lat.	Long.	Depth
Jul. 10, 1975	10:28–10:40	56°59.2'–56°59.1'N	165°31.9'–165°32.1'W	74 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
cloudy	6.4	S–8.0	1006.9	3	4	6	9

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4–P (		Tot-P		SiO_2–Si μg at/l		NO_3–N		NO_2–N	NH_4–N	NH_4–N)	ex
0	4.0	31.778	25.25	273	8.086	8.054	109.0	108.6	−0.667	−0.635	8.382	8.361	2.219	2.211	0.35	0.37	0.85		25	50	0.1	0.0	0.04	0.2	0.9	2.0
10	3.91	776	26	272	8.099	8.105	108.9	109.0	−0.664	−0.669	398	370	218	218	0.33	0.37	0.78		14	14	0	0	05	4	9	1.3
20	3.87	772	26	272	8.011	8.035	107.6	107.9	−0.568	−0.591	383	372	222	222	0.37	0.33	0.80		21	12	0	0	05	5	1.1	1.0
30	−0.44	901	65	235	7.570	7.495	91.1	90.2	0.742	0.817	119	109	225	225	1.44	1.47	1.72		31	32	11.2	10.9	12	4.0	4.2	3.0
40	−0.49	901	65	235	7.538	7.558	90.6	90.8	785	766	111	109	227	229	1.50	1.49	1.83		31	29	11.0	11.1	14	4.1	4.6	4.9
50	−0.49	903	65	235	7.586	7.559	91.1	90.8	738	765	101	103	234	231	1.54	1.51	1.86		20	29	11.1	11.1	13	3.8	2.5	4.8
59	−0.48	897	65	235	7.555	7.527	90.8	90.5	767	795	095	098	239	238	1.49	1.54	1.79		20	21	11.1	11.1	14	4.0	4.8	3.2
69	−0.48	898	65	235	7.534	7.408	90.6	89.0	787	913	093	095	243	245	1.48	1.47	1.83		29	30	11.7	11.6	13	4.0	4.8	2.9

* Water samples were collected by Nansen bottles.

Table 15. Summary of hydrographic data at Station 15*

Date	Time	Lat.	Long.	Depth
Jul. 10, 1975	20:50–21:00	56°59.6'–56°59.6'N	162°59.0'–162°59.1'W	60 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
cloudy	6.2	SE–3.0	1012.4	2	2	7	9

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4–P (		Tot-P		SiO_2–Si μg at/l		NO_3–N		NO_2–N	NH_4–N	NH_4–N)	ex
0	5.8	31.810	25.08	289	8.086	8.093	113.9	114.0	−0.986	−0.994	8.345	8.360	2.211	2.207	0.41	0.42	1.05	1.10	10	6	0.0	0.1	0.03	0.7	0.7	0.1	0.2
10	5.49	805	12	286	8.186	8.185	114.4	114.4	−1.032	−1.031	351	372	212	206	38	43	0.90	0.95	7	2	1	0	03	7	5	2	2
20	5.33	812	14	284	8.057	8.016	112.2	111.6	−0.876	−0.835	345	361	210	210	52	40	88	88	5	10	0	0	04	7	7	5	5
30	1.28	747	44	255	7.712	7.720	97.0	97.1	0.238	0.231	202	208	214	216	1.13	1.12	1.48	1.46	8	8	2.0	2.0	08	5.9	6.3	3.6	2.4
40	1.26	741	44	255	7.664	7.681	96.3	96.6	292	274	133	219	219	218	1.17	1.12	1.48	1.56	16	8	2.0	2.0	09	6.0	6.2	2.3	3.0
50	1.16	740	44	255	7.676	7.643	96.2	95.8	300	333	204	202	219	222	1.26	–	1.52	1.52	9	8	2.0	2.0	08	6.2	6.3	2.0	1.3

* Water samples were collected by Nansen bottles.

Table 16. Summary of hydrographic data at Station 16*

Date	Time	Lat.	Long.	Depth
Jul. 11, 1975	06:45-07:04	58°15.2'-58°15.6'N	164°55.9'-164°55.7'W	44 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
overcast	5.2	ESE-5.0	1012.1	2	2	7	10

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P		SiO_2-Si μg at/l		NO_3-N		NO_2-N	NH_4-N		NH_4-N)	ox
0	3.2	31.401	25.03	294	7.621	7.638	100.4	100.7	-0.033	-0.051	8.216	8.207	2.210	2.199	0.62	0.66	1.02	1.02	2	3	0.2	0.1	0.02	0.4	0.7	0.1	0.5
10	3.16	403	03	294	7.628	7.649	100.4	100.7	-0.033	-0.054	193	197	204	207	55	57	0.88	0.90	2	2	1	2	02	5	4	3	5
20	3.16	398	03	294	7.615	7.468	100.3	98.3	-0.020	-0.127	198	195	209	209	59	57	92	96	2	2	3	2	02	5	6	5	8
30	3.10	395	03	294	7.609	7.774	100.0	102.2	-0.002	-0.167	205	191	204	205	63	60	95	98	3	2	2	2	02	5	5	4	4
40	3.09	405	04	293	7.566	7.613	99.4	100.1	0.043	-0.005	192	190	209	212	65	65	1.01	95	2	2	1	1	03	1.1	5	4	7

* Water samples were collected by Nansen bottles.

Table 17. Summary of hydrographic data at Station 17*

Date	Time	Lat.	Long.	Depth
Jul. 11, 1975	17:40-17:59	50°31.5'-50°32.0'N	167°00.1'-167°00.2'W	30 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
overcast	4.9	SE-8.0	1012.5	3	2	5	10

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P		SiO_2-Si μg at/l		NO_3-N		NO_2-N	NH_4-N		NH_4-N)	ox
0	4.5	31.450	24.94	302	7.714	7.723	105.0	105.2	-0.370	-0.379	8.347	8.344	2.215	2.213	0.10	0.09	1.02		2	3	0.0	0.1	0.03	0.4	0.5	0.6	0.7
10	4.47	444	94	303	7.714	7.730	105.0	105.2	-0.364	-0.380	378	365	195	201	12	13	0.99		1	1	0	0	03	3	7	1	2
20	4.48	449	94	302	7.750	7.706	105.5	104.9	-0.402	-0.358	381	353	203	198	10	13	96		2	2	0	0	05	3	4	5	5
28	4.48	449	94	302	7.729	7.692	105.2	104.7	-0.381	-0.344	348	350	209	206	13	11	1.09		1	0	0	0	03	4	5	5	5

* Water samples were collected by Nansen bottles.

Table 18. Summary of hydrographic data at Station 18*

Date	Time	Lat.	Long.	Depth
Jul. 12, 1975	05:43-06:10	58°15.7'-58°15.9'N	167°01.0'-167°00.9'W	54 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
overcast	4.9	SE-6.5	1014.2	2	2	6	10

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_2-N		NO_3-N	NH_4-N	NH_4-N) ox	
0	3.95	31.717	25.21	277	8.288	8.239	111.5	110.9	-0.856	-0.808	8.363	8.361	2.213	2.205	0.35	0.36	0.79	5	6	0.1	0.0	0.03	0.4	0.5	0.4	0.8
10	3.93	716	21	277	8.263	8.262	111.1	111.1	-0.828	-0.827	382	373	212	204	39	35	79	2	4	1	0	02	1	6	4	4
20	3.69	719	24	275	8.280	8.267	110.7	110.5	-0.801	-0.788	388	379	209	206	36	37	92	5	4	0	1	02	3	2	6	6
30	3.41	714	26	273	8.190	8.200	108.7	108.9	-0.658	-0.668	362	375	211	207	40	40	1.32	1	4	0	0	03	4	3	2	0
40	1.14	747	45	254	7.640	7.621	95.7	95.5	0.340	0.359	304	219	209	210	95	97	1.37	4	8	3.9	3.8	10	2.6	2.7	7	1.5
50	1.11	743	45	254	7.571	7.577	94.8	94.9	415	409	197	208	210	212	1.11	1.05	1.41	5	4	4.0	3.9	10	2.7	2.8	1.2	1.3

* Water samples were collected by Nansen bottles.

Table 19. Summary of hydrographic data at Station 19*

Date	Time	Lat.	Long.	Depth
Jul. 13, 1975	00:52-01:17	56°00.1'-55°59.9'N	167°00.5'-167°00.6'W	134 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
fog	9.5	SE-4.5	1012.5	1	2	2	10

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_2-N		NO_3-N	NH_4-N	NH_4-N) ox	
0	7.0	31.876	24.99	298	7.199	7.198	104.4	104.3	-0.301	-0.299	8.351	8.358	2.216	2.218	0.43	0.42	0.63	17	25	0.1	0.1	0.03	0.5	0.4	1.2	0.9
10	6.81	872	25.01	296	7.228	7.220	104.3	104.2	-0.298	-0.290	396	354	217	223	35	38	56	9	9	1	1	03	0.7	1.1	0.9	9
20	6.21	880	09	288	7.360	7.381	104.7	105.0	-0.332	-0.353	337	340	216	226	47	47	62	8	-	5	5	06	3.3	3.1	1.2	9
30	6.24	986	17	281	7.320	7.324	104.3	104.4	-0.302	-0.306	317	322	221	224	61	55	74	32	34	1.6	1.6	05	4.7	4.4	0.9	7
40	3.48	32.216	65	235	7.176	7.145	95.8	95.4	0.317	0.348	157	157	227	233	1.40	1.41	1.51	36	42	10.0	10.0	17	4.7	4.4	3.2	4.1
50	2.98	325	78	223	6.914	6.903	91.2	91.0	668	680	094	091	235	-	1.75	1.77	1.82	53	42	13.9	14.3	26	4.1	4.5	3.9	4.5
60	2.93	440	88	214	6.831	6.798	90.0	89.6	756	788	053	055	240	240	1.88	1.87	1.91	45	40	17.5	17.1	41	0.6	0.7	3.0	4.1
70	2.91	549	96	205	6.739	6.698	88.9	88.3	846	886	046	039	254	244	1.93	1.92	1.95	51	46	20.3	19.7	53	0.6	7	3.1	2.9
80	2.90	676	26.07	196	6.345	6.332	83.7	83.5	1.235	1.248	7.989	7.987	252	249	2.18	2.16	2.13	62	54	23.7	24.3	35	0.6	4	1.5	1.1
90	3.01	828	18	185	5.479	5.476	72.6	72.5	2.072	2.075	956	937	259	262	2.39	2.39	2.27	80	75	26.6	27.9	06	1.0	5	0.2	0.3
100	3.03	891	23	180	5.313	5.299	70.4	70.2	2.231	2.245	906	903	272	-	-	2.47	2.40	-	72	27.3	28.3	10	0.6	4	5	5
130	3.02	914	24	179	5.425	5.429	71.9	72.0	2.120	2.116	906	905	278	280	2.56	2.56	2.47	74	69	28.8	27.9	10	0.4	5	4	5

* Water samples were collected by Nansen bottles.

Table 20. Summary of hydrographic data at Station 20*

Date	Time	Lat.	Long.	Depth
Jul. 13, 1975	08:30-09:55	54°59.7'-55°00.6'N	168°00.7'-168°01.0'W	1180 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
cloudy	8.1	E-12.0	1005.3	4	3	7	10

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_3-N		NO_2-N	NH_4-N	NH_4-N) ox	
0	6.8	32.696	25.66	235	6.994	6.961	101.5	101.0	-0.100	-0.067	8.254	8.259	2.247	2.244	1.18	1.22	1.27	37	35	8.1	8.5	0.15	1.8	2.0	1.3
9	6.83	693	65	235	6.957	6.962	101.0	101.1	-0.068	-0.073	264	231	265	260	1.09	1.11	1.24	29	32	7.9	8.0	14	1.9	1.7	1.8
26	6.75	693	66	234	6.980	6.977	101.1	101.1	-0.077	-0.074	268	265	250	260	1.09	1.16	1.22	32	29	8.0	8.1	13	1.8	2.0	2.5
44	4.40	760	99	203	6.885	6.843	94.3	94.4	0.414	0.406	146	138	257	252	1.69	1.73	1.72	37	37	16.1	15.8	26	2.9	1.8	0.7
64	3.30	868	26.18	185	7.085	7.064	94.5	94.3	410	431	057	056	273	272	2.12	2.17	2.09	52	49	22.1	22.5	37	2.7	2.0	3.0
85	3.08	922	25	179	7.942	6.941	92.2	92.1	591	593	031	035	276	277	2.17	2.23	2.17	54	51	25.8	24.8	40	1.5	2.2	1.9
126	2.75	33.110	42	162	7.664	6.650	87.8	87.7	923	937	7.999	004	282	285	2.41	2.39	2.32	57	57	29.0	29.0	08	0.1	2.3	0.6
167	2.73	202	50	155	7.303	6.298	83.1	83.0	1.283	1.288	975	7.986	287	295	2.38	2.43	2.35	61	62	30.3	30.4	10	2	0.5	4
208	2.64	241	54	151	7.192	6.224	81.5	81.9	1.409	1.377	985	979	298	303	2.33	2.32	2.32	59	61	30.6	30.6	13	2	6	4
247	3.18	383	60	145	4.666	4.656	62.3	62.2	2.825	2.836	853	881	307	317	2.74	2.67	2.60	75	73	33.6	33.8	15	3	6	7
405	3.59	742	85	121	2.422	2.435	32.7	32.9	4.976	4.963	712	727	320	329	3.12	3.08	2.96	95	95	39.3	39.5	03	2	1	1
574	3.38	34.029	27.10	98	1.198	1.194	16.1	16.1	6.224	6.228	639	657	350	363	3.40	3.38	3.22	122	124	42.7	42.6	02	2	5	0
750	3.13	220	27	81	0.662	0.657	8.9	8.8	6.797	6.802	608	617	371	380	3.56	2.49	3.31	139	139	44.3	43.7	03	1	1	3
932	2.93	305	36	73	612	588	8.2	7.9	6.881	6.904	644	658	390	404	3.43	3.42	3.24	152	150	44.1	44.0	03	1	2	0
1120	2.59	411	47	62	619	641	8.2	8.5	6.932	6.911	645	668	424	427	3.58	3.59	3.34	168	168	44.3	43.5	04	2	7	8

* Water samples were collected by Nansen bottles.

Table 21. Summary of hydrographic data at Station 26*

Date	Time	Lat.	Long.	Depth
Jul. 18, 1975	06:10-10:41	49°59.7'-49°58.8'N	155°00.1'-155°00.7'W	4800 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
overcast	8.5	NW-9.5	1013.2	4	4	6	10
drizzle		W-11.0	1013.5				

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_3-N		NO_2-N	NH_4-N	NH_4-N) ox
0	8.6	32.764	25.45	254	6.910	6.898	104.5	104.3	-0.298	-0.287	8.211	8.209	2.247	2.247	1.58	1.56	1.69	37	35	14.9	15.1	0.20	0.5	1.4 0.9
10	8.66	773	45	254	6.915	6.907	104.7	104.6	-0.313	-0.305	198	197	252	254	1.48	1.51	1.68	36	35	15.3	15.2	25	8	2.4 3.3
30	6.67	802	76	225	7.166	7.136	103.7	103.3	-0.256	-0.226	180	181	257	259	1.48	1.46	1.55	36	35	16.3	16.2	20	9	- 1.5
50	5.10	854	99	203	7.175	7.180	100.1	100.1	-0.004	-0.009	159	164	261	262	1.65	1.59	1.66	34	35	17.7	17.8	21	1.4	2.5 1.0
75	4.69	867	26.04	198	7.175	7.148	99.1	98.7	0.067	0.094	142	148	263	259	1.72	1.70	1.79	35	35	18.3	18.4	34	1.0	3.2 2.2
100	4.14	934	15	187	6.893	6.900	94.0	94.0	0.444	0.437	119	112	281	273	1.84	1.85	1.85	37	37	20.6	20.4	15	0.5	1.8 2.5
150	4.01	33.724	79	126	3.236	3.244	44.2	44.3	4.086	4.078	7.892	7.882	301	292	2.78	2.77	2.70	68	66	34.1	34.1	05	3	0.4 1.7
200	3.77	801	88	118	2.526	2.504	34.3	34.0	4.835	4.858	787	806	322	322	2.98	2.99	2.88	78	78	37.9	37.6	05	3	1.1 0.5
250	3.74	883	95	112	1.731	1.731	23.5	23.5	5.632	5.632	719	729	329	340	3.08	3.13	2.99	88	88	39.5	40.3	07	4	1.2 1.4
300	3.73	932	99	108	1.370	1.362	18.6	18.5	5.992	6.000	693	689	352	347	3.15	3.14	3.12	94	95	41.7	42.0	03	4	0.5 0.8
500	3.53	34.155	27.18	90	0.704	0.707	9.5	9.6	6.684	6.681	673	658	371	385	3.47	3.50	3.29	117	117	43.2	42.9	02	4	7 3
700	3.25	282	31	77	567	569	7.6	7.7	6.867	6.864	680	670	398	403	3.59	3.58	3.29	134	133	41.9	42.3	05	5	6 7
900	2.92	368	41	68	515	517	6.9	6.9	6.976	6.974	685	670	411	410	3.63	3.66	3.38	146	146	43.9	44.4	03	3	1.0 1.1
1100	2.66	438	49	61	599	594	8.0	7.9	6.937	6.943	693	692	417	417	3.54	3.51	3.29	155	155	44.1	44.4	03	3	1.1 1.0
1300	2.44	487	55	55	712	690	9.4	9.1	6.864	6.886	698	699	430	432	3.61	3.61	3.30	161	163	44.2	44.3	01	3	- 0.7
1413	2.34	517	58	52	865	822	11.4	10.8	6.729	6.772	696	713	448	440	3.62	3.60	3.34	166	166	43.1	43.0	02	3	0.7 9
1500	2.26	525	59	51	874	885	11.5	11.6	6.735	6.724	677	715	447	444	3.63	3.65	3.38	166	167	42.5	42.1	05	9	4 6
1649	2.12	573	64	46	1.073	1.077	14.1	14.1	6.561	6.556	700	724	455	445	3.51	3.55	3.32	170	172	42.0	41.7	04	6	- 2
1885	1.97	601	68	43	1.368	1.363	17.9	17.8	6.294	6.298	746	744	449	453	3.43	3.47	3.22	172	172	41.0	39.4	03	3	0.7 7
2120	1.86	619	70	41	1.635	1.631	21.3	21.2	6.047	6.052	770	767	455	454	3.40	3.39	3.14	172	172	40.6	40.1	03	3	8 4
2356	1.74	636	72	39	1.917	1.872	24.9	24.3	5.787	5.833	783	782	458	467	3.32	3.33	3.16	174	174	40.1	39.9	05	3	- 1
2594	1.68	650	74	37	2.154	2.144	27.9	27.8	5.562	5.572	794	794	470	472	3.28	3.28	3.03	176	177	40.0	40.1	03	4	0.0 1
2830	1.62	666	76	35	2.429	2.432	31.4	31.5	5.298	5.295	851	839	472	-	3.20	3.20	2.91	171	172	37.8	38.6	04	6	9 0
3068	1.57	673	76	35	2.692	2.680	34.8	34.6	5.045	5.057	893	846	473	469	3.13	3.17	2.87		170	38.6	38.7	05	4	- 5
3304	1.53	681	77	34	2.924	2.917	37.8	37.7	4.820	4.827	869	854	477	472	3.13	3.17	2.82	168	167	38.2	38.3	02	4	0.2 0
3540	1.51	687	78	33	2.999	2.990	38.7	38.6	4.749	4.758	926	887	480	476	2.85	2.86	2.50	169	167	36.7	36.6	02	5	1.4 2
3776	1.49	695	79	32	3.181	3.181	41.0	41.0	4.570	4.571	888	854	477	470	3.02	3.07	2.77	167	167	37.1	36.9	04	4	1.7 2
4014	1.49	695	79	32	3.218	3.216	41.5	41.5	4.534	4.536	897	879	477	471	3.01	2.97	2.68	172	168	35.2	35.8	05	1.9	1.7 2.2
4251	1.51	704	79	32	3.302	3.299	42.6	42.6	4.445	4.448	908	880	480	475	3.08	3.00	2.76	171	170	35.9	36.7	05	0.5	0.8 0.5
4490	1.53	700	79	32	3.260	3.262	42.1	42.1	4.483	4.481	917	895	481	480	2.86	2.80	2.56	170	172	36.3	34.8	02	2.1	1.9 7

* Water samples were collected by Nansen bottles.

Table 22. Summary of hydrographic data at Station 30*

Date	Time	Lat.	Long.	Depth
Aug. 2, 1975	19:39-23:43	49°59.1'-49°57.4'N	144°28.1'-144°27.9'W	4150 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
overcast	11.6	W-11.0	1009.2	6	6	6	10
fog	10.9	W- 8.0	1009.7	5		5	

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P		SiO_2-Si μg at/l		NO_2-N		NO_3-N	NH_4-N	NH_4-N)	ox
0	10.3	32.602	25.05	292	6.603	6.585	103.6	103.4	-0.231	-0.213	8.156	8.182	2.241	2.243	1.24	1.23	1.41	1.46	41	46	18.7	18.2	0.14	2.3	1.8	1.1
10	10.32	601	05	292	6.604	6.622	103.7	104.0	-0.235	-0.253	178	203	247	255	09	08	39	39	55	39	17.6	16.3	21	0.6	0.3	0.3
30	8.15	674	45	254	6.993	6.991	104.6	101.1	-0.310	-0.308	196	213	261	256	08	10	27	30	38	29	18.5	19.3	22	1.6	2.2	3.0
50	6.55	708	70	231	7.046	7.009	101.6	101.1	-0.112	-0.075	178	188	256	253	26	25	37	47	39	35	22.0	23.5	27	2.2	4.0	3.0
75	5.11	767	92	210	7.009	6.995	97.8	97.5	0.163	0.177	125	144	261	254	33	36	53	55	42	34	23.7	25.5	98	1.1	1.6	2.6
100	4.54	806	26.01	201	6.998	7.004	96.2	96.3	272	267	098	125	265	259	53	54	65	66	48	42	30.2	30.6	10	1.1	0.4	0.7
150	4.90	33.614	61	144	4.385	4.388	61.2	61.2	2.784	2.781	7.934	7.938	297	304	2.18	2.22	2.24	2.31	55	62	35.7	39.3	04	2.3	-	0
200	4.50	820	82	124	3.172	4.164	43.9	43.8	4.057	4.065	805	829	331	330	56	52	61	62	87	85	40.3	39.8	07	1.0	0.0	-
250	4.22	869	89	118	2.209	2.207	30.4	30.3	5.067	5.070	773	779	345	345	75	75	76	82	96	85	39.0	38.2	07	1.5	2.0	2.0
300	4.09	924	94	112	1.534	1.543	21.0	21.1	5.763	754	702	706	361	358	93	93	98	3.00	124	91	40.1	39.0	10	0.9	0.8	2.1
499	3.68	34.120	27.14	94	0.763	0.764	10.4	10.4	6.598	6.598	622	651	370	373	3.28	3.30	3.26	24	133	129	39.4	41.9	03	0.6	-	0.3
698	3.35	259	28	80	487	477	6.6	6.4	6.928	938	628	636	399	396	40	38	34	35	148	136	37.5	42.2	05	2.7	-	1.2
897	3.04	353	39	70	416	421	5.6	5.6	7.052	7.048	628	635	425	424	42	41	36	41	169	157	42.6	42.8	02	0.8	0.0	0.1
1095	2.73	428	48	62	506	495	6.7	6.6	7.017	7.027	629	649	435	435	31	33	26	30	169	163	43.4	39.8	02	1.0	0	0
1292	2.50	476	53	56	589	570	7.8	7.5	6.976	6.994	645	651	436	444	44	39	35	34	173	174	43.3	39.2	03	0.4	0	4
1356	2.46	485	54	55	641	629	8.5	8.3	6.930	6.943	657	672	437	440	30	28	29	28	185	171	35.8	40.9	03	0.4	2	1
1488	2.30	520	59	52	752	753	9.9	9.9	6.849	6.848	650	650	436	439	40	42	34	36	181	177	41.5	40.1	06	0.9	0	0
1586	2.24	544	61	49	0.836	0.861	11.0	11.3	6.774	6.750	686	671	445	452	38	35	32	28	181	195	40.5	38.2	05	1.0	1	0
1818	2.04	578	65	45	1.139	1.164	14.9	15.2	6.509	6.484	707	713	448	458	23	30	16	20	191	180	39.0	37.1	05	0.7	1.2	1.2
2052	1.91	606	69	42	1.432	1.409	18.7	18.4	6.240	6.263	732	724	462	469	21	21	13	16	-	195	40.4	42.5	05	1.1	1.1	0.7
2287	1.79	625	71	40	1.720	1.701	22.4	22.1	5.975	5.993	755	749	473	479	10	05	04	07	187	185	40.0	40.5	05	0.5	0.2	8
2521	1.71	643**	73	38	2.020	2.039	26.2	26.5	5.689	5.670	787	785	486	481	09	09	2.97	2.98	190	183	36.6	38.1	06	1.3	1.6	1.3
2754	1.64	660	75	36	2.330	2.326	30.2	30.1	5.393	5.396	821	820	494	493	01	01	92	94	187	180	37.5	37.6	11	0.5	1.4	1.1
2986	1.58	670	76	35	2.577	2.555	33.3	33.0	5.157	5.179	816	825	490	491	2.89	2.88	83	86	177	179	35.4	-	07	2.7	0.7	0.8
3218	1.54	682	77	34	2.747	2.749	35.5	35.5	4.995	4.992	833	838	500	488	93	92	79	81	186	184	39.4	36.0	08	1.8	5	7
3450	1.53	688	78	33	2.816	2.789	36.4	36.0	4.927	4.954	866	884	518	516	59	56	45	43	174	178	38.7	37.6	09	1.1	6	9
3683	1.51	687	78	33	3.029	3.037	39.1	39.2	4.718	4.710	866	847	509	504	84	85	70	74	181	181	37.0	36.3	07	0.4	8	1.3

* Water samples were collected by Nansen bottles.
** Values interpolated.

Table 23. Summary of hydrographic data at Station 33*

Date	Time	Lat.	Long.	Depth
Aug. 11, 1975	05:05-09:08	47°55.9'-47°55.0'N	171°00.7'-171°01.2'E	6100 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
cloudy	11.4	SE-2.0	1022.3	1	3	8	9
	11.6	calm	1022.7		2	7	

Dep. (m)	Temp. (°O)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_2-N		NO_3-N	NH_4-N	NH_4-N)	ox
0	11.2	32.756	25.02	295	6.540	6.541	104.8	104.8	−0.298	−0.299	8.151	8.152	2.269	2.269	1.59	1.65	1.75	35	37	15.5	15.9	0.19		0.1	0.2
10	10.99	759	07	292	6.548	6.570	104.4	104.8	−0.278	−0.300	165	163	269	272	1.55	1.57	1.71	35	36	16.0	15.6	17		0.2	0.3
30	5.26	33.043	26.12	191	6.532	6.488	91.6	90.9	0.602	0.645	146	150	277	276	1.79	1.79	1 88	44	45	20.5	20.0	22		1.7	2.2
49	3.39	085	35	169	7.443	7.437	99.7	99.6	023	029	075	075	279	280	1.99	2.05	2.04	49	49	24.1	21.9	55		1.7	3.0
74	2.38	132	47	157	7.487	7.496	97.8	97.9	169	160	072	071	278	282	2.02	2.10	2.09	47	49	23.9	23.8	57		2.4	1.9
99	1.86	177	55	150	7.391	7.394	95.3	95.3	365	362	058	059	280	293	2.11	2.12	2.11	52	49	24.2	24.8	03		0.9	2.7
148	2.24	400	70	136	5.221	5.203	68.1	67.8	2.449	2.467	7.882	7.892	286	301	2.59	2.59	2.55	66	67	31.0	30.1	02		2.1	0.8
197	3.04	729	89	117	2.643	2.655	35.2	35.4	4.857	4.845	717	727	320	313	3.12	3.11	3.05	88	88	38.3	37.2	02		0.2	1.5
246	3.22	831	96	111	1.952	1.935	26.2	25.9	5.509	5.526	665	670	326	326	3.15	3.13	3.06	99	96	39.8	40.9	04		1.6	1.7
296	3.30	930	27.03	104	1.436	1.444	19.3	19.4	6.005	5.997	652	663	340	344	3.24	3.25	3.22	107	105	41.0	42.6	02		1.0	1.5
493	3.30	34.163	21	87	0.802	0.805	10.8	10.8	6.627	6.624	624	618	358	364	3.47	3.51	3.37	125	125	43.3	43.2	02		0.4	1.8
690	3.08	298	34	75	499	492	6.7	6.6	6.965	6.972	614	609	376	388	3.51	3.49	3.43	143	143	44.9	44.4	02		1.2	1.0
887	2.77	379	43	66	738	755	9.8	10.1	6.780	6.762	634	632	400	400	3.54	3.48	3.33	151	154	44.8	44.6	00		1.0	0.7
1084	2.55	440	50	60	775	769	10.3	10.2	6.781	6.787	652	634	418	–	3.47	3.43	3.26	158	158	43.8	44.4	00		1.7	1.3
1281	2.36	493	56	54	838	837	11.0	11.0	6.753	6.754	651	638	426	418	3.52	3.54	3.34	168	167	43.9	44.0	01		0.9	1.2
1392	2.27	514	58	52	970	1.008	12.8	13.3	6.637	6.599	659	656	431	427	3.50	3.54	3.24	170	171	44.0	42.9	01		1.5	1.6
1478	2.20	534	60	50	984	1.023	12.9	13.4	6.635	6.596	659	652	424	429	3.48	3.64	3.34	170	169	44.4	43.9	01		0.0	0.0
1625	2.08	563	64	47	1.253	1.246	16.4	16.3	6.388	6.394	692	697	436	439	3.44	3.53	3.20	173	174	42.8	42.4	02		0	0
1857	1.93	593	67	43	1.551	1.548	20.2	20.2	6.118	6.121	720	722	443	441	3.40	3.44	3.15	174	173	41.1	42.5	01		0	0
2089	1.81	618	70	40	1.941	1.941	25.2	25.2	5.750	5.750	753	743	448	445	3.27	3.27	3.09	173	170	41.3	42.0	02		0	0
2324	1.71	640	73	38	2.206	2.206	28.6	28.6	5.503	5.504	778	771	450	447	3.19	3.16	2.94	170	174	39.4	39.5	03		0	0
2558	1.65	651	74	37	2.497	2.472	32.3	32.0	5.224	5.249	784	792	452	450	3.13	3.17	2.87	170	172	38.9	39.0	01		0	0
2792	1.59	668	76	35	2.685	2.704	34.7	35.0	5.047	5.028	816	811	457	455	3.05	3.06	2.81	167	165	38.3	37.7	03		0	1
3026	1.54	674	77	34	2.921	2.897	37.7	37.4	4.821	4.844	831	826	460	459	3.05	3.02	2.79	164	163	36.8	37.2	05		0	0
3258	1.51	680	77	34	3.091	3.082	39.9	39.8	4.656	4.666	834	829	463	464	3.03	3.02	2.75	166	164	37.2	38.5	02		0	0
3491	1.49	687	78	33	3.150	3.168	40.6	40.9	4.601	4.583	908	899	466	465	2.73	2.70	2.49	158	159	36.3	36.6	03		0	0
3724	1.47	687	78	33	3.379	3.375	43.6	43.5	4.376	4.380	864	853	471	466	3.13	2.92	2.66	158	159	36.6	36.2	04		0	2
3955	1.46	692	79	32	3.438	3.432	44.3	44.3	4.319	4.324	866	858	473	471	2.88	2.90	2.61	158	156	36.0	35.7	11		0	5
4189	1.49	692	79	33	3.500	3.506	45.2	45.2	4.250	4.245	866	865	486	479	2.88	2.85	2.67	158	156	35.4	35.9	04		6	0
4422	1.50	692	78	33	3.484	3.490	45.0	45.0	4.264	4.258	870	867	486	487	2.75	2.71	2.47	155	156	35.6	36.1	08		1	2
4654	1.53	690	78	33	3.574	3.563	46.2	46.0	4.169	4.180	862	867	491	493	2.79	2.75	2.55	154	154	35.2	35.7	15		3	8

* Water samples were collected by Nansen bottles.

Table 24. Summary of hydrographic data at Station 35*

Date	Time	Lat.	Long.	Depth
Aug. 12, 1975	11:37-15:57	46°58.1'-46°56.8'N	167°00.8'-167°00.7'E	5900 m

Weather	Air temp.	Wind	Bar. pressure	Sea	Swell	Visibility	Cloud amount
cloudy	11.4	W-7.0	1020.3	2	3	7	10
	11.5	W-5.5	1019.6		2	6	

Dep. (m)	Temp. (°C)	Sal. (‰)	σ_t	Δ_{st} (cl/ton)	O_2 (ml/l)		O_2sat. (%)		AOU (ml/l)		pH		Alk		PO_4-P (		Tot-P	SiO_2-Si μg at/l		NO_3-N		NO_2-N	NH_4-N	NH_4-N) ox	
0	11.8	32.789	24.93	303	6.539	6.541	106.1	106.2	-0.378	-0.381	8.170	8.176	2.264	2.256	1.37	1.41	1.60	22	24	13.0	13.0	0.18		1.2	0.8
10	11.07	802	25.08	290	6.653	6.669	106.3	106.6	-0.395	-0.412	189	192	262	253	1.28	1.33	1.65	22	20	12.6	12.5	17		0.8	0.9
30	3.74	33.051	26.29	175	7.790	7.768	105.2	104.9	-0.386	-0.364	149	152	272	266	1.69	1.72	1.96	38	39	19.2	19.2	26		1.3	1.3
50	2.36	087	44	160	7.587	7.571	99.0	98.8	0.075	0.071	093	098	278	271	1.89	1.91	2.15	63	43	21.6	21.4	57		1.9	2.2
75	1.75	098	49	155	7.539	7.559	96.9	97.1	243	224	068	079	285	283	2.02	2.06	2.16	49	44	24.0	24.1	20		0.3	0.4
100	1.63	189	57	147	7.287	7.283	93.4	93.3	514	519	039	047	293	298	2.11	2.15	2.25	55	48	25.5	25.4	05		3	1
150	2.55	526	77	129	4.465	4.451	58.7	58.5	3.138	3.152	7.836	7.843	310	304	2.68	2.72	2.79	68	69	33.1	32.3	02		2	0
200	2.95	729	90	117	2.539	2.561	33.8	34.1	4.977	4.956	690	705	322	324	3.06	3.14	3.17	87	87	38.3	38.1	02		0	1
250	3.09	834	97	110	1.681	1.665	22.5	22.2	5.804	5.820	654	661	330	338	3.26	3.28	3.34	96	100	41.1	42.6	03		0	1
300	3.19	912	27.02	105	1.326	1.318	17.8	17.7	6.136	6.144	635	644	349	359	3.25	3.26	3.40	103	108	41.9	42.2	01		1	0
500	3.26	34.165	22	86	0.894	0.903	12.0	12.1	6.543	6.533	604	616	371	375	3.45	3.44	3.43	122	123	41.9	42.5	02		0	0
700	2.99	294	35	74	694	697	9.3	9.3	6.786	6.783	610	606	394	395	3.47	3.52	3.43	142	142	43.9	41.1	02		0	0
900	2.75	382	44	66	715	736	9.5	9.8	6.806	6.785	621	608	412	411	3.51	3.56	3.45	151	153	43.0	42.7	01		0	1
1100	2.51	453	51	58	812	811	10.7	10.7	6.751	6.753	629	636	420	418	3.42	3.43	3.46	158	158	42.6	43.7	00		0	0
1300	2.30	502	57	53	880	871	11.6	11.5	6.722	6.730	646	656	422	415	3.49	3.52	3.41	167	167	42.7	43.1	01		0	0
1389	2.23	518	59	51	957	972	12.6	12.8	6.657	6.643	666	669	426	420	3.51	3.46	3.40	170	169	42.3	42.8	00		2	1
1500	2.15	542	62	49	1.087	1.079	14.2	14.1	6.542	6.550	647	661	422	418	3.47	3.49	3.32	170	169	44.1	43.5	00		0	0
1621	2.05	569	64	46	1.284	1.275	16.8	16.7	6.362	6.371	683	701	431	429	3.36	3.36	3.30	170	172	42.1	41.8	02		3	2
1852	1.92	597	68	43	1.582	1.570	20.6	20.5	6.089	6.100	723	737	435	444	3.32	3.31	3.23	170	171	41.6	42.0	01		0	0
2084	1.78	623	71	40	1.922	1.947	25.0	25.3	5.775	5.750	763	760	440	452	3.26	3.23	3.20	170	168	39.4	40.2	01		2	1
2315	1.68	643	73	38	2.259	2.266	29.3	29.4	5.456	5.449	773	774	449	449	3.17	3.13	3.10	167	168	38.8	38.3	02		0	0
2546	1.62	657	75	36	2.517	2.505	32.6	32.4	5.210	5.221	792	791	453	453	3.10	3.08	3.01	166	167	38.7	37.5	01		0	0
2776	1.57	668	76	35	2.717	2.728	35.1	35.3	5.019	5.008	833	823	461	461	3.04	3.03	2.93	162	161	38.0	37.7	03		0	2
3007	1.55	678	77	34	2.907	2.896	37.6	37.4	4.832	4.843	831	840	468	465	2.96	2.96	2.86	159	158	36.7	36.8	05		0	3
3238	1.515	683	78	33	3.096	3.090	40.0	39.9	4.650	4.656	835	840	477	477	2.95	2.95	2.85	158	158	35.8	36.2	02		0	0
3468	1.505	687**	78	33	3.138	3.118	40.5	40.2	4.610	4.630	935	933	492	485	2.68	2.66	2.64	156	155	35.6	35.2	00		0	0

* Water samples were collected by Nansen bottles.
** Value extrapolated.

Table 25. Summary of hydrographic data at G-1 Station

Date: Jul. 17, 1975
Time: 08:10-08:30
Lat.: 52°09.8'N
Long.: 161°01.5'W
Depth: 4600 m
Weather: overcast
Air temp.: 7.6°C
Wind: W-8.5
Bar. pressure: 1016.1
Sea: 3
Swell: 3
Visibility: 7
Cloud amount: 10
Transparency: 17 m
Surface irradiance: 12,000 lux

Dep. (m)	Temp. (°C)
0	7.6
10	7.5
20	7.5
30	7.5
40	7.5
50	7.4
75	3.4
100	3.6
125	4.2
150	4.2
175	4.2
200	4.2

Dep. (m)	Sal. (‰)	NO_3^-	NO_2^-	NH_4^- (Phe)	NH_4^- (Oxi)	SiO_2	PO_4		Chl. a	Chl. c	POC	PON
		(			μg atom/l			)	(μg/l)		(μg/l)	
0	32.719	15.5	0.18	0.7	0.9	24.9	1.48	1.46	0.030	0.019	79.1	10.5
8	717	15.3	18	0.8	1.2	23.6	1.48	1.49	028	020	71.7	8.3
17	715	15.3	20	1.0	1.2	24.4	1.48	1.48	028	097	71.7	8.5
23	714	15.2	18	0.8	1.1	25.2	1.51	1.49	032	018	89.5	11.8
56	849	19.4	35	1.9	1.3	32.8	1.84	1.83	029	018	51.3	7.0
85	33.343	32.4	08	0.4	0.6	57.4	2.62	2.63	009	005	55.1	6.4

Table 26. Summary of hydrographic data at G-2 Station

Date: Jul. 18, 1975
Time: 10:42-11:30
Lat.: 49°58.8'N
Long.: 155°00.7'W
Depth: 4800 m
Weather: drizzle
Air temp.: 8.5°C
Wind: W-11.0
Bar. pressure: 1013.5
Sea: 4
Swell: 4
Visibility: 6
Cloud amount: 10
Transparency: 11 m
Surface irradiance: 28,200 lux

Dep. (m)	Temp. (°C)
0	8.6
10	8.5
20	8.5
30	7.5
40	6.0
50	5.2
75	4.7
100	4.2
125	4.1
150	4.2
175	4.1
200	4.0

Dep. (m)	Sal. (‰)	NO_3^-	NO_2^-	NH_4^- (Phe)	NH_4^- (Oxi)	SiO_2	PO_4		Chl. a	Chl. c	POC	PON
		(			μg atom/l			)	(μg/l)		(μg/l)	
0	32.769	15.0	0.23	0.6	1.2	35.6	-	-	0.83	0.54	157	28.1
7	765	15.4	21	7	0.6	35.6	1.52	1.53	64	39	131	21.4
14	763	15.3	21	9	6	35.8	1.46	1.53	72	46	129	20.9
19	765	15.1	22	6	1.4	36.5	1.50	1.50	66	61	143	21.5
46	844	17.2	18	1.2	1.3	35.0	1.63	1.67	37	21	46.6	4.8
69	878	18.1	37	1.3	1.4	35.0	1.68	1.72	14	11	58.9	8.8

Table 27. Summary of hydrographic data at G-3 Station

Date: Jul. 19, 1975
Time: 08:05-08:45
Lat.: 49°57.5'N
Long.: 151°38.9'W
Depth: 4850 m
Weather: drizzle
Air temp.: 9.2°C
Wind: W-9.5
Bar. pressure: 1011.4
Sea: 4
Swell: 4
Visibility: 6
Cloud amount: 10
Transparency: 9 m
Surface irradiance: 8,000 lux

Dep. (m)	Temp. (°C)
0	9.1
10	9.0
20	9.0
30	8.6
40	6.0
50	5.6
75	5.3
100	4.6
125	4.5
150	4.5
175	4.4
200	4.3
225	4.2
250	4.0

Dep. (m)	Sal. (‰)	NO_3^-	NO_2^-	NH_4^- (Phe)	NH_4^- (Oxi)	SiO_2	PO_4		Chl. a	Chl. c	POC	PON
		(			μg atom/l			)	(μg/l)		(μg/l)	
0	32.696	14.0	0.18	0.7	1.2	33.6	1.39	1.36	0.76	0.52	143	24.8
7	694	13.8	18	7	1.3	0	1.41	1.39	75	47	89.8	12.7
14	685	14.0	18	6	0.6	29.4	1.41	1.40	76	49	141	25.0
19	693	14.0	18	6	8	8	1.40	1.36	72	54	-	-
46	810	16.5	17	9	4	30.6	1.60	1.60	47	28	73.3	10.0
68	824	17.0	20	1.2	1.0	32.6	1.64	1.65	24	14	43.5	5.4

Table 28. Summary of hydrographic data at G-4 Station

Date: Jul. 20, 1975
Time: 08:17-08:55
Lat.: 50°00.6'N
Long.: 144°28.7'W
Depth: 4200 m
Weather: overcast
Air temp.: 10.4°C
Wind: S-7.0
Bar. pressure: 1013.7
Sea: 3
Swell: 3
Visibility: 7
Cloud amount: 10
Transparency: 17 m
Surface irradiance: 30,000 lux

Dep. (m)	Temp. (°C)
0	9.8
10	9.8
20	9.8
30	9.5
40	7.4
50	7.0
75	5.8
100	5.0
125	4.6
150	4.9
175	5.1
200	5.0
225	4.8
250	4

Dep. (m)	Sal. (‰)	NO_3^-	NO_2^-	NH_4^- (Phe)	NH_4^- (Oxi)	SiO_2	PO_4		Chl. a	Chl. c	POC	PON
		(			μg atom/l			)	(μg/l)		(μg/l)	
0	32.672	12.3	0.15	0.8	1.2	29.6	1.32	1.32	0.32	0.19	63.9	10.2
9	654	12.6	15	9	1.0	26.9	1.35	1.33	31	18	145	21.6
18	675	12.5	15	8	0.7	25.1	1.33	1.35	26	19	66.8	8.8
27	658	12.7	15	9	1.3	7	1.32	1.35	29	18	73.3	9.4
60	712	13.5	17	1.3	2.1	27.0	1.44	1.41	39	33	65.7	8.1
90	752	15.1	33	1.5	3.3	30.4	1.58	1.55	24	14	24.6	3.4

Table 29. Summary of hydrographic data at G-5 Station

Date: Jul. 21, 1975
Time: 08:04-08:40
Lat.: 49°54.5'N
Long.: 138°48.1'W
Depth: 3930 m
Weather: overcast
Air temp.: 11.6°C
Wind: SE-7.5
Bar. pressure: 1015.8
Sea: 3
Swell: 2
Visibility: 7
Cloud amount: 10
Transparency: 17 m
Surface irradiance: 30,000 lux

Dep. (m)	Temp. (°C)
0	11.1
10	10.9
20	10.8
30	8.7
40	8.2
50	7.5
75	5.9
100	5.4
125	5.3
150	5.2
175	5.5
200	5.5
225	5.3
250	4.8

Dep. (m)	Sal. (‰)	NO_3^-	NO_2^-	NH_4^+ (Phe)	NH_4^+ (Oxi)	SiO_2	PO_4		Chl. a (µg/l)	Chl. c (µg/l)	POC (µg/l)	PON (µg/l)
		(			µg atom/l			)				
0	32.575	6.8	0.17	1.2	1.4	12.6	0.88	0.89	0.39	0.23	60.9	10.1
10	572	6.8	16	1.3	0.8	11.8	88	90	36	23	70.6	11.9
20	571	6.9	15	1.1	9	10.7	89	88	35	21	92.2	12.9
30	611	7.6	12	1.1	6	15.8	91	94	42	26	88.5	13.7
66	652	10.8	29	2.0	2.0	19.0	1.24	1.23	36	23	53.0	8.5
100	689	13.6	69	1.3	1.3	21.0	1.36	1.34	25	13	33.1	5.0

Table 30. Summary of hydrographic data at G-6 Station

Date: Jul. 22, 1975
Time: 08:04-08:50
Lat.: 49°20.3'N
Long.: 131°20.8'W
Depth: 2530 m
Weather: overcast
Air temp.: 13.6°C
Wind: SSE-9.0
Sea: 3
Swell: 3
Visibility: 7
Cloud amount: 10
Transparency: 17 m
Surface irradiance: 24,000 lux

Dep. (m)	Temp. (°C)
0	13.3
10	12.9
20	12.0
30	11.0
40	9.4
50	8.0
75	7.3
100	6.8
125	6.6
150	6.7
175	6.9
200	6.8
225	6.5
250	5.8

Dep. (m)	Sal. (‰)	NO_3^-	NO_2^-	NH_4^+ (Phe)	NH_4^+ (Oxi)	SiO_2	PO_4		Chl. a (µg/l)	Chl. c (µg/l)	POC (µg/l)	PON (µg/l)
		(			µg atom/l			)				
0	32.359	0.2	0.02	1.5	0.4	0.46	0.43	0.45	0.22	0.11	72.4	13.4
10	382	1	02	1.2	6	46	47	46	21	09	70.2	11.5
19	324	0	02	1.3	3	47	46	46	31	14	106	16.5
29	335	1	04	1.3	4	51	50	51	82	50	128	22.8
64	557	5.6	16	2.1	1.9	73	92	74	24	15	52.3	7.7
96	673	8.9	15	1.1	0.9	1.04	1.03	1.06	13	07	44.0	6.1

Table 31. Chlorophyll (µg chl./l), POC and PON (µg/l) at hydrographic stations

Sta. 2 Jun. 27, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	-	-	-	-	-
10	-	-	-	-	-
20	-	-	-	-	-
30	0.54	0.26	0.40	95.2	16.6
50	36	11	20	104	12.8
75	26	11	11	64.7	7.5
100	09	05	05	62.3	7.2
125	09	02	03	93.6	7.1
150	08	05	02	45.2	5.2
175	12	01	03	85.2	10.7
200	08	01	02	44.5	5.0
444	-	-	-	74.8	-
657	-	-	-	91.8	-
869	-	-	-	58.8	-
1082	-	-	-	61.1	-
1294	-	-	-	101	-

* Uncorrected..
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 3 Jun. 28, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	-	-	-	153	18.3

* Uncorrected.
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 4 Jun. 29, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	0.97	0.44	1.01	295	46.9
10	74	22	0.73	349	56.3
20	1.02	37	94	275	44.3
30	2.91	1.18	3.23	423	84.5
50	0.67	0.18	0.60	133	16.8
75	38	16	27	143	21.0
100	27	07	18	53.7	7.3
125	21	04	14	55.3	6.8
150	21	06	12	68.5	9.2
175	23	07	11	76.5	9.7
200	19	01	08	73.3	11.1
293	-	-	-	101	14.8
486	-	-	-	135	11.4
679	-	-	-	81.5	9.9
872	-	-	-	146	20.9
1065	-	-	-	61.8	7.8
1244	-	-	-	111	16.8

* Uncorrected.
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 5 Jun. 30, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	0.64	0.79	0.71	193	29.0
10	52	50	60	193	32.6
20	53	28	62	214	33.3
30	67	40	78	217	35.5
50	44	35	24	105	16.6
75	14	14	06	61.1	7.0
100	14	17	05	76.0	10.0
125	14	20	04	95.6	14.4
150	11	14	05	134	11.1
175	-	-	-	-	-
200	09	11	02	93.6	10.2
325	-	-	-	74.2	8.7
519	-	-	-	72.0	5.4
712	-	-	-	71.4	6.7
906	-	-	-	53.5	5.6

* Uncorrected.
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 6 Jul. 1, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.44	131	21.2
10	54	104	14.7
20	73	123	18.8
30	50	109	18.8
50	25	70.0	10.0
75	08	36.2	4.7
100	06	39.6	5.6
125	04	28.5	3.5
150	06	29.4	3.3
175	04	36.6	3.1
200	-	-	-
291	-	40.6	4.2
485	-	35.6	2.2
679	-	42.2	3.3
873	-	30.2	2.4
1087	-	29.5	2.3
1382	-	55.0	5.5
1678	-	32.5	3.0
1974	-	52.4	3.4
2270	-	22.8	3.0
2566	-	34.0	3.3
2842	-	35.5	3.0
3136	-	16.1	1.0
3430	-	25.3	2.6
3724	-	21.6	1.6
4018	-	22.3	1.1
4312	-	23.3	1.8

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 7 Jul. 2, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.46	241	37.0
10	40	185	28.8
20	55	135	22.9
30	21	137	23.8
50	07	87.8	14.9
75	02	38.8	6.1
100	01	45.0	5.1
125	01	40.1	5.3
150	01	71.5	5.2
175	02	78.7	6.2
200	01	53.9	9.1
297	-	43.0	7.6
494	-	78.3	8.8
692	-	72.7	8.2
890	-	48.4	4.3
1083	-	51.4	5.5
1280	-	29.8	5.4
1477	-	66.0	6.1
1723	-	45.2	5.8
1970	-	47.2	5.4
2216	-	67.6	6.7
2450	-	42.3	4.8
2695	-	43.6	4.2
2940	-	30.6	3.3
3185	-	32.7	3.6
3430	-	36.9	4.8
3675	-	74.7	7.2

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 8 Jul. 5, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.78	161	48.2
10	96	122	26.0
20	60	161	30.7
30	31	125	23.5
50	11	81.6	17.4
75	02	37.4	6.3
100	02	38.7	4.4
125	02	22.6	2.8
150	02	33.5	4.3
175	-	-	-
200	01	38.2	4.7
290	-	53.3	6.7
483	-	50.3	5.2
676	-	32.5	2.7
870	-	85.0	7.1

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 9 Jul. 6, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.63	121	18.9
10	52	113	13.3
20	71	115	17.2
30	1.08	127	20.1
50	0.73	78.5	8.3
75	22	42.9	4.0
100	07	58.7	5.6
125	06	56.3	5.8
150	03	41.9	4.0
175	-	-	-
200	02	47.1	4.5
293	-	40.6	3.3
489	-	26.5	2.7
684	-	25.6	2.1
880	-	42.4	2.6
1078	-	20.8	1.4
1274	-	33.5	2.7
1470	-	51.2	3.0
1715	-	20.0	1.6
1960	-	40.8	2.9
2205	-	18.7	1.1
2401	-	28.8	3.0
2641	-	35.2	3.5
2881	-	22.3	1.6
3121	-	25.4	2.6
3362	-	33.1	2.6
3602	-	33.9	3.0

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 10 Jul. 7, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	1.07	131	21.6
10	06	153	23.6
20	05	79.5	17.7
30	10	186	26.2
50	0.80	94.6	16.0
75	25	43.3	6.6
100	10	44.7	5.9
125	04	37.0	5.4
150	03	53.5	6.4
175	-	-	-
200	02	52.8	6.5
292	-	26.8	4.6
487	-	43.3	-
681	-	40.0	5.5
876	-	23.8	-
1048	-	38.7	5.0
1239	-	21.9	-
1430	-	22.5	4.0
1668	-	28.6	-
1906	-	19.9	3.3
2145	-	36.3	-
2392	-	32.4	5.2
2631	-	25.8	-
2870	-	41.0	7.6
3109	-	26.2	-
3348	-	41.2	6.4
3588	-	41.9	-

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 11 Jul. 8, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	0.44	0.27	0.52	114	11.9
10	46	24	55	77.8	9.5
20	50	21	63	77.6	11.0
30	28	15	28	46.0	10.0
50	14	11	10	33.7	7.2
75	13	15	06	71.2	6.0
100	12	05	04	26.9	2.8
125	11	05	03	52.4	4.7
150	10	03	04	29.8	2.7
175	10	04	04	33.5	2.7
200	09	04	03	32.1	3.5
296	-	-	-	48.2	5.6
497	-	-	-	33.8	3.5
697	-	-	-	25.5	1.8
901	-	-	-	33.2	3.2
1102	-	-	-	39.0	2.9
1303	-	-	-	56.0	-
1492	-	-	-	38.4	3.3
1739	-	-	-	26.7	2.2
1986	-	-	-	23.9	1.2
2261	-	-	-	60.7	9.1
2511	-	-	-	19.1	1.4
2762	-	-	-	42.0	7.9
3008	-	-	-	31.7	2.4
3257	-	-	-	39.4	3.6
3498	-	-	-	46.2	3.8

* Uncorrected.
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 12 Jul. 9, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.45	95.6	14.9
10	44	109	16.3
20	94	98.6	14.6
30	70	111	16.6
50	87	149	23.0
75	50	113	14.7
100	53	84.1	-
125	63	154	16.0

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 13 Jul. 9, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	1.84	227	36.1
10	57	208	31.7
20	35	256	39.0
30	0.92	181	28.0
40	1.95	204	28.5
50	2.07	233	34.0
60	66	212	30.4
69	54	261	39.6

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 14 Jul. 10, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	2.14	1.52	2.17	267	43.2
10	1.89	2.02	1.96	278	44.8
20	2.13	2.22	2.69	269	44.1
30	2.20	1.09	3.25	224	35.6
40	3.07	1.56	2.61	199	28.1
50	2.88	1.08	3.21	207	30.9
60	2.45	1.35	2.79	149	21.2
70	2.52	1.17	3.40	177	28.1

* Uncorrected.
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 15 Jul. 10, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	1.73	0.71	1.62	292	-
10	0.59	0.70	1.64	315	-
20	2.44	1.11	2.51	298	-
30	1.58	0.92	1.43	215	31.7
40	0.97	1.00	0.66	153	22.1
50	0.92	0.61	1.59	179	-

* Uncorrected.
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 16 Jul. 11, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	0.94	0.28	1.05	125	18.2
10	0.96	64	1.14	158	22.4
20	0.98	42	0.94	112	16.0
30	1.06	30	1.16	107	15.5
40	1.35	42	1.50	152	22.7

* Uncorrected.
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 17 Jul. 11, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	2.13	0.86	1.53	1039	67.5
10	3.37	1.39	1.82	821	79.4
20	1.51	0.48	1.51	496	33.3
28	2.63	1.06	2.95	664	49.7

* Uncorrected.
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 18 Jul. 12, '75

Depth* m	Chl. a**	Chl. c** µg/l	Chl. a+	POC µgC/l	PON µgN/l
0	1.33	1.48	1.40	456	47.0
10	2.15	1.24	1.48	525	72.4
20	1.29	1.37	1.46	462	42.8
30	2.93	2.23	1.73	426	46.6
40	3.46	1.70	2.67	460	51.1
50	5.46	2.46	5.07	517	53.7

* Uncorrected.
** Determined by the spectrophotometric method.
\+ Determined by the fluorometric method.

Sta. 19 Jul. 13, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.62	82.8	10.9
10	55	85.8	11.6
20	59	110	15.0
30	49	64.8	8.9
40	27	59.5	7.5
50	17	59.7	7.6
60	07	46.2	5.7
80	03	53.5	5.9
100	04	85.9	9.6
130	11	157	16.8

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 20 Jul. 13, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.55	65.1	8.9
10	49	57.7	6.5
20	57	61.4	7.3
30	23	53.3	6.4
50	23	44.2	5.7
75	08	35.9	4.1
100	03	29.3	2.4
125	02	27.7	3.0
150	02	41.3	3.6
175	02	29.2	2.9
200	-	-	-
268	-	54.2	4.5
447	-	126	8.7
626	-	33.5	2.5
984	-	31.9	2.2

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 26 Jul. 18, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.99	152	21.9
10	82	150	20.0
20	84	175	24.7
30	78	170	22.9
50	35	101	11.9
75	21	53.8	4.6
100	24	29.8	3.2
125	04	72.4	8.1
150	02	42.3	4.0
200	02	76.8	6.4
305	-	38.2	3.6
518	-	51.2	4.4
731	-	39.7	4.4
944	-	34.9	3.1
1156	-	42.0	3.5
1369	-	64.6	6.8
1535	-	62.7	5.4
1786	-	33.9	3.1
2037	-	29.7	2.6
2288	-	33.0	3.5
2540	-	32.9	2.8
2791	-	40.3	4.1
3203	-	30.1	3.3
3467	-	25.2	1.8
3732	-	19.9	1.9
3996	-	58.3	5.4
4261	-	43.6	3.9

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 30 Aug. 2, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.40	79.2	13.8
10	44	92.6	16.1
20	41	166	23.7
30	36	111	18.9
50	23	66.2	9.9
75	13	37.0	4.2
100	03	37.9	4.7
125	02	71.1	10.0
150	02	33.7	4.4
175	03	63.0	9.4
200	01	47.8	6.2
272	-	32.1	3.7
445	-	38.1	4.1
706	-	35.1	2.8
910	-	50.8	4.7
1150	-	71.6	9.1
1368	-	60.8	8.8
1597	-	54.4	6.2
1807	-	42.7	4.1
2120	-	41.7	5.5
2397	-	24.3	3.1
2708	-	19.0	2.2
2977	-	20.9	2.4
3276	-	81.4	11.5
3546	-	50.6	5.9
3833	-	40.9	5.3

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 33 Aug. 11, '75

Depth* m	Chl. a+ µg/l	POC µgC/l	PON µgN/l
0	0.42	100	14.9
10	35	106	15.5
20	39	157	19.8
30	47	101	-
50	69	162	18.6
75	-	68.7	7.7
100	-	69.4	7.2
125	-	246	17.7
150	-	94.4	10.8
175	-	129	14.3
275	-	73.9	8.0
458	-	59.4	-
642	-	46.9	5.0
825	-	39.7	-
1007	-	50.2	4.7
1190	-	44.5	4.2
1373	-	27.8	2.3
1602	-	37.8	-
1831	-	59.9	7.4
2060	-	79.9	-
2318	-	181	18.6
2781	-	48.5	-
3245	-	58.4	7.6
3708	-	51.9	-
4172	-	58.0	7.9
4635	-	41.2	-

* Uncorrected.
\+ Determined by the fluorometric method.

Sta. 35 Aug. 12, '75

Depth* m	POC µgC/l	PON µgN/l
0	120	16.3

* Uncorrected.

Table 32. Summary of hydrographic data at S stations

No.	Date	Time	Lat.	Long.	T (°C)	S (‰)	PO_4 (		SiO_2 μg at/l		NO_3+NO_2		NH_4)		POC* μgC/l	PON μgN/l
S 1	Jun. 22	06:00	36°18.3'N	142°03.2'E	20.0	34.246	0.04	0.09	5	8	0.4		1.6	0.5	-	-
2		12	37 12.6	143 00.3	19.7	421	01	01	16	11	0.2		0.7	0.2	-	-
3		18	38 14.3	59.9	19.5	773	14	05	18	31	0.4		1.3	0.9	-	-
4		00	56.5	145 03.0	19.2	377	-	-	-	-	-		-	-	-	-
5		06	39 52.1	57.8	15.5	112	0.07	0.13	14	7	0.2		0.0	0.3	-	-
6		12	40 19.0	146 50.5	11.5	33.172	88	90	19	19	3.8		2.2	1.6	-	-
7		18	41 07.9	147 26.8	14.0	878	35	31	3	0	0.2		0.9	0.9	-	-
8	24	00	42.9	148 41.0	8.0	32.940	58	57	34	34	0.3		0.9	0.9	-	-
9		06	42 06.1	00.1	9.7	33.130	75	77	5	6	3.3		0.8	1.3	-	-
10	26	00	43 04.3	145 44.4	9.5	32.917	58	51	33	28	3.3	2.9	1.4	1.2	-	-
11		06	27.3	147 10.8	6.7	982	83	90	41	47	9.0	3.7	1.3	7	-	-
12		12	53.3	148 39.9	-	924	87	96	19	18	7.1	7.2	0.0	0.8	-	-
13		18	44 17.0	150 06.2	8.3	987	1.13	1.32	46	71	12.9	13.1	0.5	2.1	-	-
14	28	01	47 00.8	154 30.0	4.5	33.042	1.64	1.70	-	50	17.0	17.0	1.0	1.7	-	-
15		12	30.3	155 24.1	5.5	32.968	1.23	1.35	38	48	16.2	16.4	0.9	2.3	121	17.0
16		18	48 24.9	156 32.2	5.9	33.015	1.82	1.75	54	55	21.0	20.6	3.9	4	107	13.4
17	29	18	50 28.2	159 25.8	-	32.415	0.26	0.25	4	3	0.1	0.5	3.7	1.5	101	13.2
18	30	00	51 13.3	160 43.1	7.7	33.086	1.15	1.16	21	20	15.2	15.0	3.2	1.8	104	14.8
19	Jul. 1	00	53 04.2	163 32.3	7.1	061	0.94	0.92	10	10	12.5	12.5	1.8	1.0	300	33.9
20	2	00	55 13.0	165 10.2	-	32.929	48	46	7	7	1.2	1.2	0.8	0.9	103	17.9
21		06	56 21.3	166 18.6	7.2	33.148	1.38	1.34	46	43	12.6	12.7	1.2	1.8	89.3	13.3
22	5	00	59.7	169 36.8	7.4	32.994	0.85	0.86	11	12	5.8	5.7	1.9	0.4	140	21.5
23		18	59.0	173 05.0	-	33.131	1.48	1.45	19	20	16.7	17.1	0.2	1	69.9	9.9
24	6	18	58.7	176 22.6	6.2	083	1.66	1.67	17	18	16.6	16.8	1.0	1.5	88.1	13.4
25	7	21	57 01.8	178 54.3'W	6.3	32.969	1.65	1.68	28	30	17.1	16.7	0.9	0.8	108	13.5
26	8	20	07.2	175 13.9	6.2	-	1.37	1.40	4	4	10.2	10.1	2.5	1.8	164	29.1
27	9	18	04.2	169 52.0	5.1	32.101	0.47	0.48	0.3	2.5	0.3	0.3	0.5	0.5	182	28.2
28	16	18	53 40.2	165 24.9	7.5	31.853	64	64	16	16	1.3	1.4	0.6	1.2	94.2	14.7
29	17	00	02.2	163 34.8	8.2	32.639	1.21	1.21	13	13	10.7	10.8	2.1	1.5	54.4	7.0
30		06	52 23.1	161 37.8	8.0	733	1.37	1.37	19	19	14.8	14.9	2.2	0.7	91.8	14.5
31		12	51 50.7	160 06.3	8.2	676	1.45	1.47	25	24	15.2	15.1	3.6	3.0	84.7	13.1
32		18	12.7	168 17.2	8.5	761	1.63	1.67	39	37	16.9	17.0	0.7	0.9	72.5	10.5
33	18	00	50 41.4	156 49.8	8.4	769	1.68	1.70	35	36	17.5	17.9	2.3	2.3	74.8	10.2
34	19	06	49 56.8	152 20.2	9.4	749	1.52	-	32	32	15.6	15.5	0.5	0.4	102	16.8
35		12	59.3	150 36.0	9.5	688	1.34	1.37	31	32	13.1	13.0	2.1	2.9	160	31.0
36		18	59.5	148 29.7	9.9	670	1.34	1.35	28	28	13.0	13.0	0.0	0.3	141	23.5
37	20	00	59.0	146 25.2	10.4	647	1.33	1.34	26	26	12.5	12.7	1	2	97.3	14.7
38		18	50 00.5	143 07.8	11.1	626	1.18	1.15	22	20	10.6	10.8	8	1.1	88.4	10.7
39	21	00	49 59.6	141 26.2	10.7	638	1.27	1.26	22	22	12.2	12.2	7	0.7	82.4	11.5
40		06	57.2	139 28.2	11.2	613	0.98	0.99	16	14	8.3	8.1	6	7	90.0	16.4
41		12	50.3	137 43.0	12.1	-	58	58	8	11	1.9	1.9	7	6	51.4	6.2
42		18	42.3	135 41.7	12.9	32.362	48	49	7	7	0.3	0.3	8	1.1	116	15.2
43	22	00	35.3	134 02.6	14.9	414	52	53	11	10	1.1	1.1	1.5	1.5	45.2	5.7
44		06	23.3	132 02.4	13.6	217	45	48	15	14	0.0	0.0	1.7	1.0	53.9	7.3
45		12	12.8	130 20.6	14.8	075	37	37	10	9	2	0.2	1.8	0.9	65.7	10.5
46		18	48 59.5	128 23.2	16.3	148	39	40	7	6	1.3	1.2	1.2	1.3	56.8	8.2
47	23	00	13.1	126 45.7	16.1	068	35	33	7	7	0.1	0.1	0.1	0.2	69.1	11.4
48		06	29.6	124 52.9	11.1	400	1.87	1.87	36	35	22.6	22.2	1.2	1.2	149	31.6
49	31	00	31.8	45.1	11.0	31.750	2.03	2.02	54	52	-	-	1.2	0.8	132	25.7
50		06	49.2	126 37.4	12.0	32.172	0.86	0.86	28	26	-	-	2.8	2.4	152	27.4
51		12	49 02.3	128 21.1	14.8	090	30	34	26	22	-	-	1.6	1.4	56.0	9.3
52		18	14.9	130 11.1	14.9	055	34	33	15	16	-	-	1.6	2.0	69.6	10.0
53	Aug. 1	00	27.3	132 15.8	13.6	338	42	40	14	12	-	-	0.3	0.2	77.2	9.1
54		06	33.8	134 07.8	13.5	374	49	49	15	9	-	-	1.4	1.5	57.1	8.7
55		12	42.7	135 58.8	13.1	332	43	47	13	5	-	-	0.7	0.9	62.4	8.2
56		18	47.7	137 51.5	12.3	537	68	71	17	17	-	-	3	2	120	20.9
57	2	00	53.3	139 45.2	11.2	568	99	1.00	17	17	-	-	9	1.0	78.7	12.6
58		06	57.9	141 27.2	11.0	565	1.11	1.17	21	21	-	-	0	0.1	76.6	10.6
59		12	50 01.7	142 48.0	11.2	566	1.15	1.16	20	20	-	-	3	7	84.9	11.8
60	4	18	12.8	146 52.0	10.8	600	1.27	1.27	25	27	10.8	10.8	5.9	5.9	131	19.3
61	5	00	12.4	148 51.6	9.8	734	1.53	1.54	32	32	14.8	15.0	3.2	4.6	105	11.6
62		06	12.9	150 37.8	10.2	708	1.48	1.51	33	34	14.1	14.3	2.2	0.9	269	20.6
63		12	11.1	152 31.6	10.1	728	1.56	1.57	34	33	14.7	15.2	1.2	1.3	103	13.2
64		18	11.7	154 25.1	10.1	751	1.56	1.53	33	33	14.6	14.6	0.8	0.8	95.9	13.3
65	6	00	10.9	156 29.9	9.9	752	1.60	1.60	32	32	15.5	15.8	1.0	9	81.5	12.4
66		06	12.0	158 17.0	9.8	742	1.65	1.64	34	33	16.3	16.4	1.3	1.3	70.4	9.6
67		12	12.3	160 07.6	9.8	784	1.68	1.60	34	35	15.7	15.9	3.6	3.7	79.8	11.6
68		18	10.8	162 03.3	10.1	741	1.42	1.35	32	35	14.6	14.5	6.3	0.4	144	21.8
69	7	00	10.9	164 00.4	9.9	696	1.34	1.32	32	31	14.5	14.7	1.7	1.4	138	25.4
70		06	09.6	165 56.7	9.5	494	1.11	1.16	17	17	11.0	11.2	0.2	0.1	80.2	14.0
71		12	07.0	167 53.6	9.6	493	1.19	1.19	15	19	11.4	11.4	2	1	110	19.8
72		18	03.1	169 49.9	9.9	548	1.13	1.13	17	19	10.7	10.7	1.0	1.2	118	20.6
73	8	00	49 55.1	172 07.6	10.1	616	1.17	1.15	20	21	10.5	11.4	0.9	1.0	129	22.6
74		06	46.2	173 57.8	9.6	600	1.06	1.10	13	11	10.8	11.0	3	0.3	168	30.9
75		12	37.4	175 45.2	9.7	788	1.33	1.48	32	36	14.3	14.4	1.3	1.9	162	25.9
76		18	25.6	177 34.8	9.5	782	1.33	1.35	23	24	12.7	12.5	1.3	-	177	32.8
77	9	00	12.0	179 29.1	9.5	887	1.39	1.40	20	23	14.0	14.4	1.2	1.7	123	21.5
78		06	01.3	178 32.8'E	9.7	881	1.48	1.54	7	8	14.2	13.7	2.5	2.3	84.1	11.3
79		12	48 44.3	176 38.8	10.3	876	1.47	1.49	29	31	15.2	15.5	1.7	1.2	91.1	15.0
80		18	30.9	174 45.8	10.6	831	1.49	1.49	25	27	14.6	14.8	1.3	1.0	79.3	11.9
81	11	00	08.0	172 36.2	11.0	939	1.47	1.50	25	23	14.5	14.7	2.4	2.0	61.5	9.7
82	12	06	47 21.7	168 30.9	11.8	822	1.55	1.54	18	19	15.0	14.9	0.9	0.9	94.7	13.6
83	13	00	46 22.9	164 39.7	13.2	987	0.93	1.95	22	23	9.6	9.4	9	9	149	24.1
84		06	45 52.2	162 55.7	13.7	33.163	1.07	1.06	26	29	10.7	10.4	7	8	107	16.6
85		12	21.3	161 13.3	13.9	623	1.29	1.32	31	38	12.5	12.1	1.3	1.2	113	16.6
86		18	44 38.2	159 21.2	16.7	728	0.35	0.25	4	5	0.2	0.2	0.2	0.3	114	16.4
87	14	00	03.8	157 39.8	15.8	32.942	45	51	4	5	2.4	2.3	7	8	162	26.2
88		06	43 26.8	156 11.2	19.7	33.331	14	13	0	1	0.1	0.1	3	3	53.9	7.5
89		12	42 50.5	154 36.5	20.9	970	11	11	1	0	0.1	0.5	2	2	57.1	7.5
90		18	13.0	153 07.3	20.8	32.727	18	21	1	0	0.8	0.7	7	7	76.8	10.6
91	15	00	41 31.8	151 37.7	21.7	33.055	15	12	2	1	0.3	0.2	4	4	160	19.3
92		06	40 51.1	150 08.0	22.9	047	18	18	2	0	0.1	0.1	2	2	60.0	8.4
93		12	07.4	148 38.5	23.5	32.865	15	15	0	-	0.0	0.0	0	0	87.0	8.9
94		18	39 26.9	147 20.9	26.5	34.067	11	08	6	-	0.1	0.1	0	0	42.3	6.4
95	16	00	38 41.4	145 44.8	26.0	33.755	00	12	3	-	0.0	0.1	1	1	50.8	5.9
96		06	37 56.0	144 25.9	26.9	34.106	06	04	2	2	1.0	1.0	0	0	47.3	6.6
97		12	12.1	143 06.7	25.8	-	-	-	-	-	-	-	-	-	-	-
98		18	36 28.4	141 46.8	27.3	-	-	-	-	-	-	-	-	-	-	-
99	17	00	35 26.9	140 53.7	24.0	-	-	-	-	-	-	-	-	-	-	-
100		06	34 53.9	139 43.6	26.0	-	-	-	-	-	-	-	-	-	-	-

* Corrected for dissolved organic carbon adsorbed on filter.

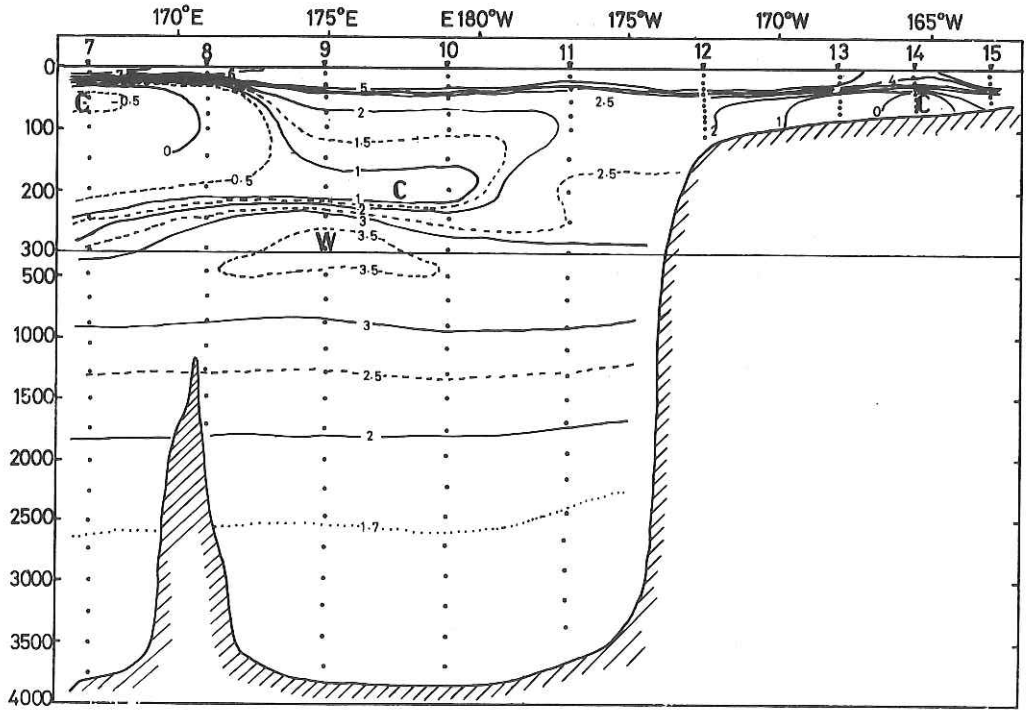

Fig. 2. Cross section of temperature (°C) in the Bering Sea along 57°N

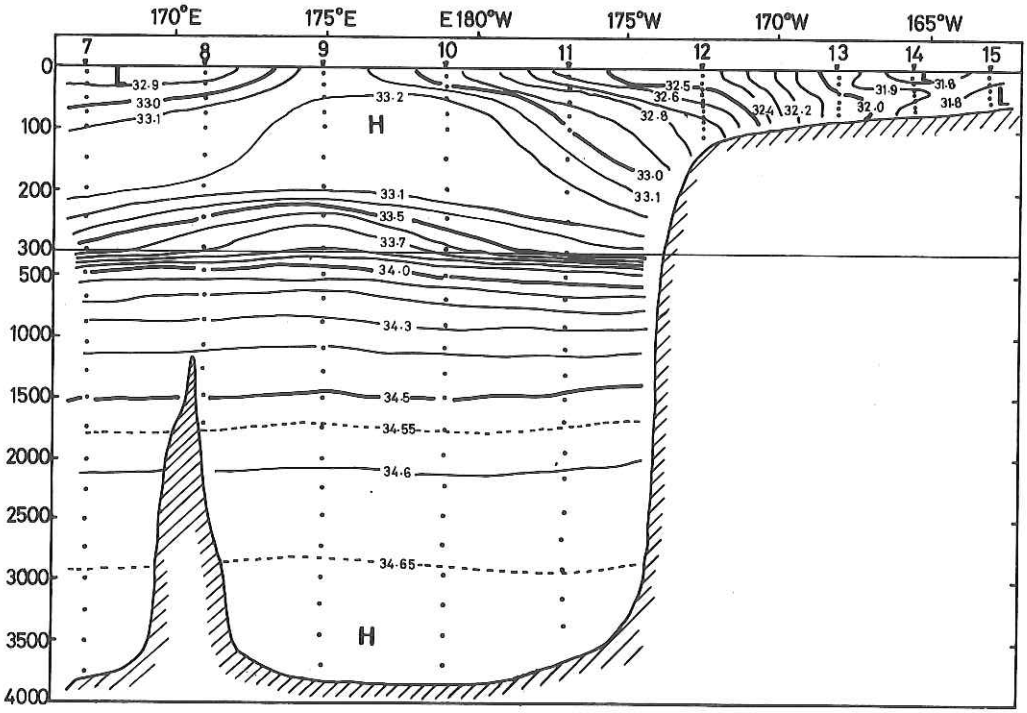

Fig. 3. Cross section of salinity (‰) in the Bering Sea along 57°N

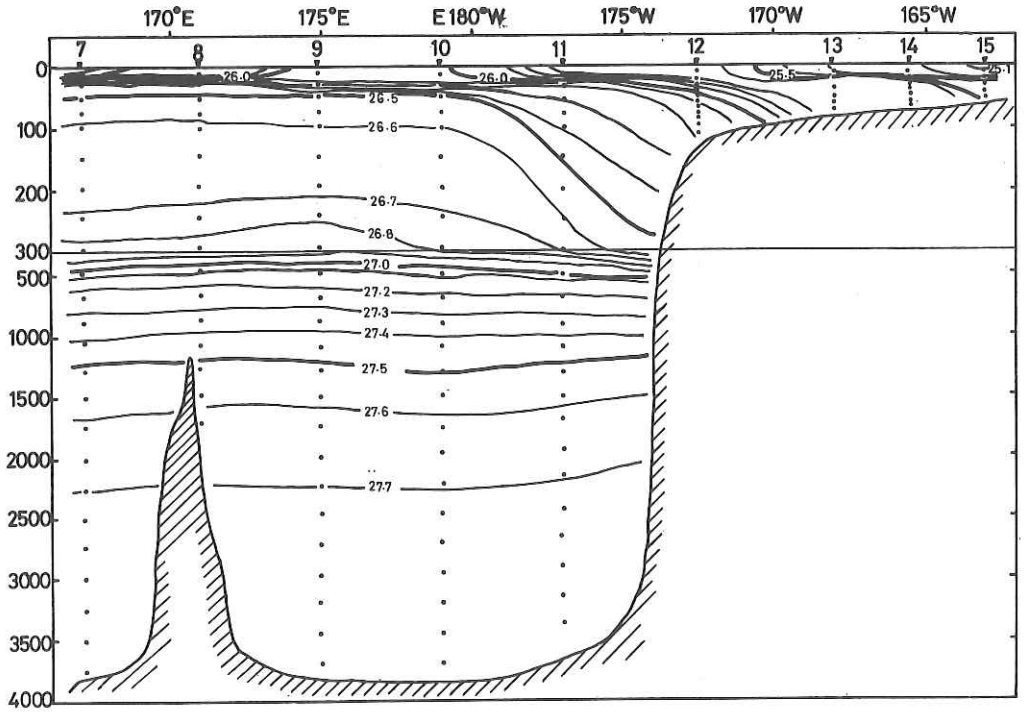

Fig. 4. Cross section of density (σ_t) in the Bering Sea along 57°N

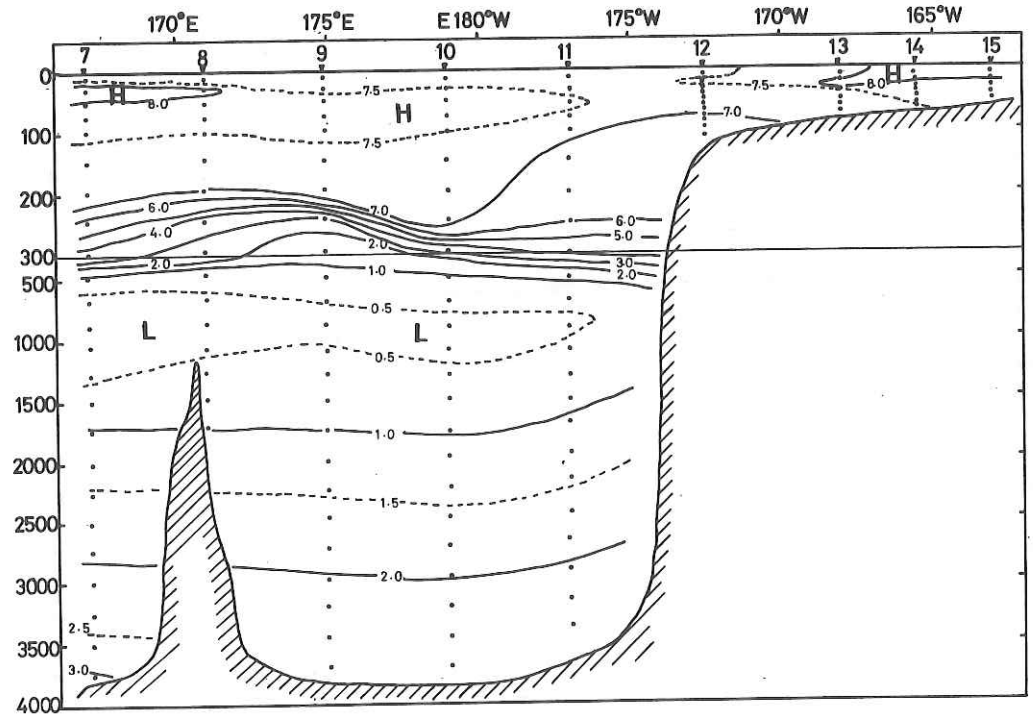

Fig. 5. Cross section of dissolved oxygen (ml/l) in the Bering Sea along 57°N

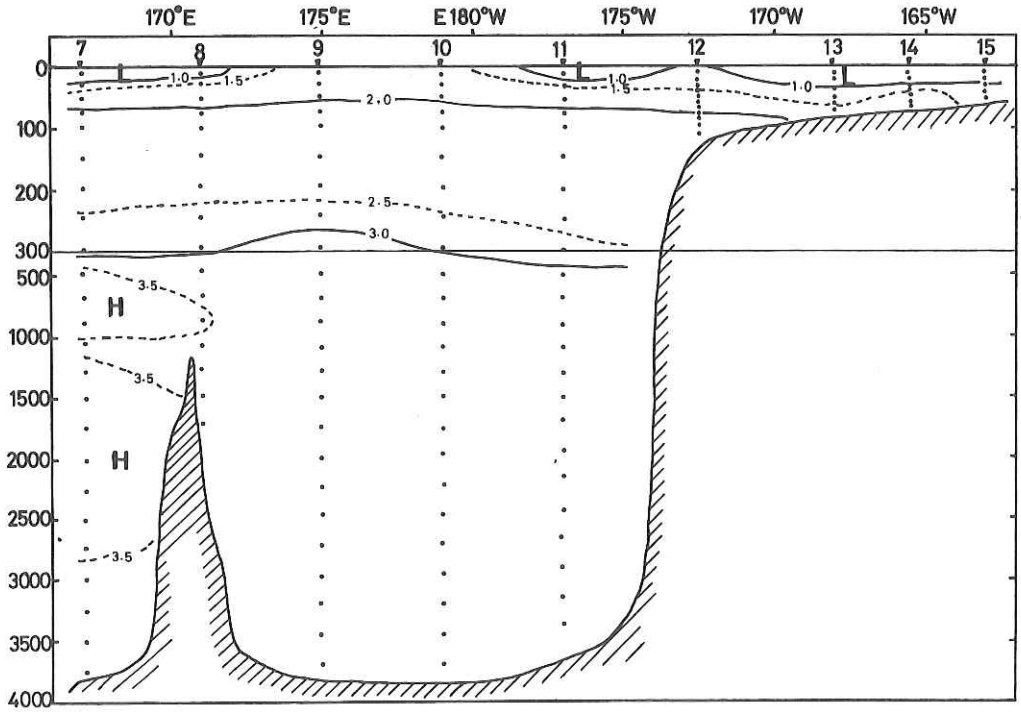

Fig. 6. Cross section of phosphate (μg at.P/l) in the Bering Sea along 57°N

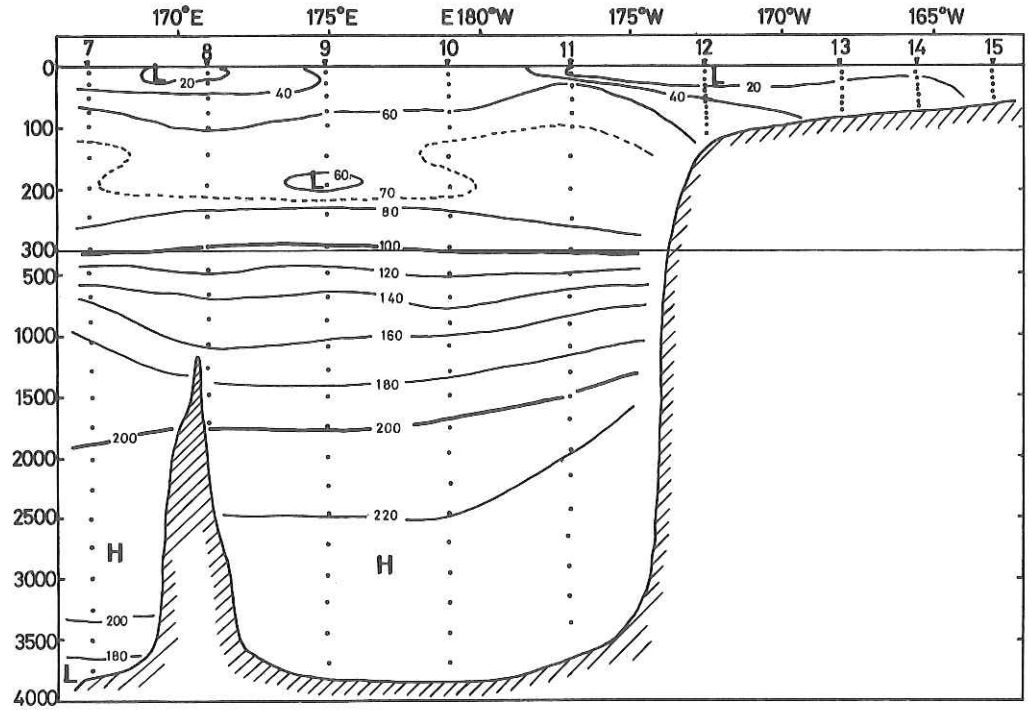

Fig. 7. Cross section of silicate (μg at.Si/l) in the Bering Sea along 57°N

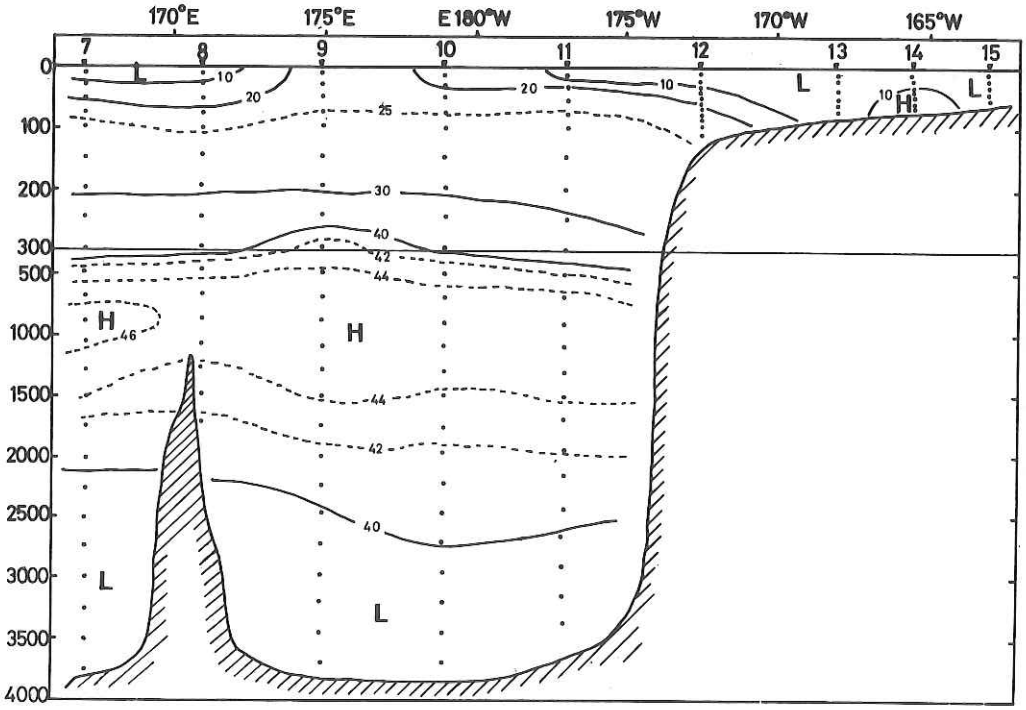

Fig. 8. Cross section of nitrate (µg at.N/l) in the Bering Sea along 57°N

Hydrographic characteristics of studied sea areas

T. Nakai, H. Otobe and A. Hattori

1. Sea area along the Kurile Islands and off Kamchatka (Stations 2-6)

Six hydrographic stations were occupied in the western subarctic gyre of the North Pacific Ocean, where the Oyashio Current flows southwestward. In the time of year we investigated, the western subarctic water was characterized by marked stratification with strong seasonal thermocline at about 20m depth and by remarkable dichothermal layer at approximately 100m depth (Fig. 9). The minimum temperature in this cold layer was about -0.5°C at Station 4. Below the temperature minimum zone, a positive temperature gradient was observed. A weak temperature maximum was located at about 200m in the northern part of this section (Station 6) and tended to lower southward. At Station 2, it was observed at about 600m.

Salinity in the surface water ranged 32.5‰ to 33.1‰. The remarkable halocline lay under the dichothermal layer, and separated the upper watermass from the deep watermass (Fig. 10). The salinity below 400m gradually increased to 34.7‰ near the bottom.

The surface oxygen contents ranged from 7ml/l to 8ml/l. The maximum oxygen content existed near the surface between 30m and 50m (Fig. 11). Below the oxygen maximum layer, a distinct oxygen transition layer was observed which coincided with the halocline.

2. The Bering Sea Basin (Stations 7-11)

The surface temperatures of this region were slightly lower than those off Kamchatka. Temperature and salinity in the western part of this section (Stations 7 and 8) were closely related to those in subarctic region of the North Pacific south of the Aleutian Islands Arc. The strong seasonal thermocline occurred between 20m and 30m depth, and a core of the cold water of about -0.5°C was observed at 50m depth at Station 7 (Fig. 2).

The thermocline became slightly deeper eastward, from 30m to 40m,

and characteristic mode water with temperature of approximately 1.5°C and salinity of 33.2‰ was located just under the thermocline at Stations 9 and 10. A tongue of low temperature of less than 1°C, 50m thick, extended eastward at about 200m depth. The mesothermal water higher than 3.5°C was centered at 300m depth of Station 9. This feature corresponded to those observed on salinity and dissolved oxygen (Figs. 3 and 5).

At Station 11, located in the eastern margin of the Bering Sea Basin, the double dichothermal layers were found in the upper layer. Surface salinity decreased gradually eastward near the continental slope.

Dissolved oxygen contents in the upper 200m were relatively homogeneous and ranged from 7ml/l to 8ml/l. An outstanding oxygen minimum with a marked oxygen gradient (Fig. 5) resided in the same depth as the halocline (Fig.3).

In the deeper layers, the distributions of temperature and salinity were similar to those in the open ocean. However, the oxygen content was much lower, attaining a value of 2.5ml/l in the eastern basin of the Olyutorski Ridge.

3. Continental shelf region (Stations 12-19)

Water structure over the shallow continental shelf is complicated owing to seasonal cooling and heating and run-off from large rivers. According to the temperature distribution (Fig. 2), two layers can be distinguished. Upper one is mixed layer extending to 30m depth. Below the seasonal thermocline to the bottom, the temperature was very cold. Salinity was nearly homogenous in the vertical plane, but laterally it decreased along latitude 57°N, from 32.5‰ in the western margin of the continental shelf to 31.8‰ in the eastern inner part. The dissolved oxygen contents increased eastward and exceeded 8ml/l at the eastern end of the section (Stations 18 and 19). The oxygen was fully or nearly fully saturated.

4. Density profiles and current

The density profiles were similar to those of temperature, and the thermocline coincided well with the pycnocline. Geostrophic currents (Table 33) are generally in good agreement with the Bering Sea circulation described by Natarov (1963), Arsen'ev (1967) and others. The calculated velocities are probably underestimated because the selection of observational line was insufficient to carry out accurate dynamic calculation.

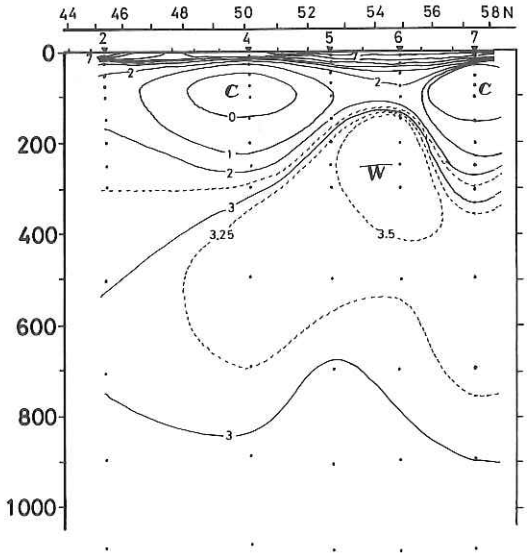

Fig. 9. Cross section of temperature (°C) in the northwestern North Pacific (cf. Fig. 1)

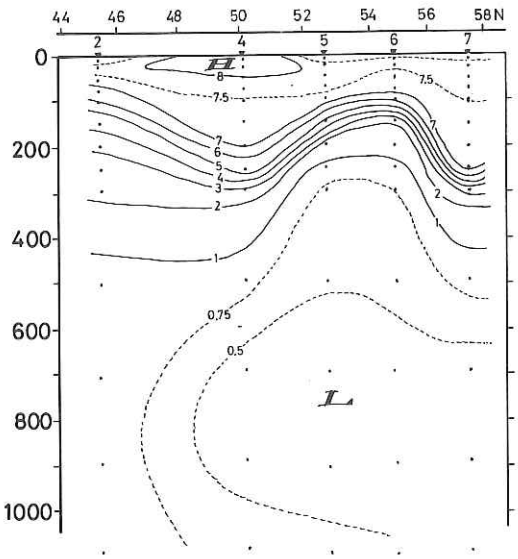

Fig. 11. Cross section of dissolved oxygen (ml/l) in the northwestern North Pacific (cf. Fig. 1)

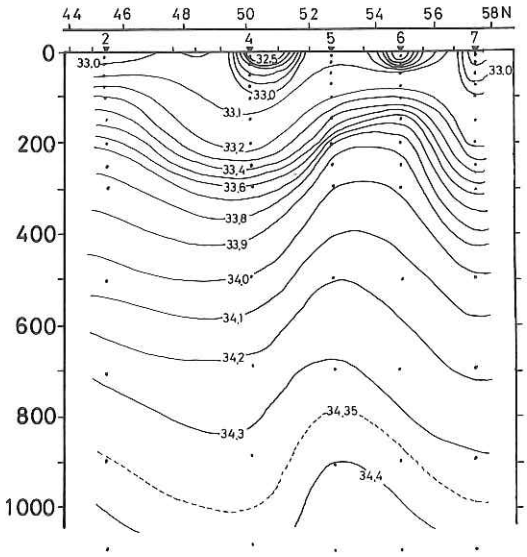

Fig. 10. Cross section of salinity (‰) in the northwestern North Pacific (cf. Fig. 1)

Table 33. Current and volume transport estimated by dynamic calculations

Stations	Distance (km)	Mean surface velocity (cm/sec)	Volume transport ($x10^6 m^3/sec$)	Flow component
2 - 4	770	-1.2	-3.9	NW
4 - 5	391	3.1	5.2	SE
5 - 6	321	-0.9	-1.7	NW
6 - 7	321	-2.8	-4.1	NW
7 - 8	235	0.6	0.6	S
8 - 9	239	0.8	1.0	S
9 - 10	248	-1.8	-2.3	N
10 - 11	243	-2.1	-0.9	N

STD observation

T. Nakai, H. Otobe and A. Hattori

The vertical distributions of salinity and temperature were measured with a HYTECH Model 9006 STD system at 14 stations in the Bering Sea (Table 34). The records are reproduced in Fig. 12.

Table 34. STD observation record

Stations	Date and Time		Position		Depth
7	Jul. 3	08:00-09:33	56°57.0'N,	167°05.5'E	3800m
8	4	06:50-08:33	57°00.7'	170°57.4'	1800
*9	6	09:53-11:40	00.5'	174°52.1'	3800
*10	7	11:07-12:30	02.0'	179°04.6'	3800
*11	7	08:05-09:52	03.6'	176°56.9'W	3650
12	9	06:55-07:34	01.4'	172°28.6'	123
13	10	00:00-00:20	56°59.4'	168°00.3'	80
14	10	11:51-12:07	58.8'	165°33.7'	72
15	10	21:29-21:47	59.8'	162°58.1'	62
16	11	07:37-07:56	58°16.4'	164°55.2'	44
17	11	17:20-17:34	59°31.1'	166°59.2'	29
18	12	06:40-07:01	58°16.4'	167°00.6'	55
19	13	00:29-00:53	56°00.3'	00.0'	135
*20	13	13:35-15:50	55°02.0'	168°01.5'	1000

* Fitted with water-samplers (Resette Multi-Sampler, Model RMS-12) and reversing-thermometers for STD caliblation.

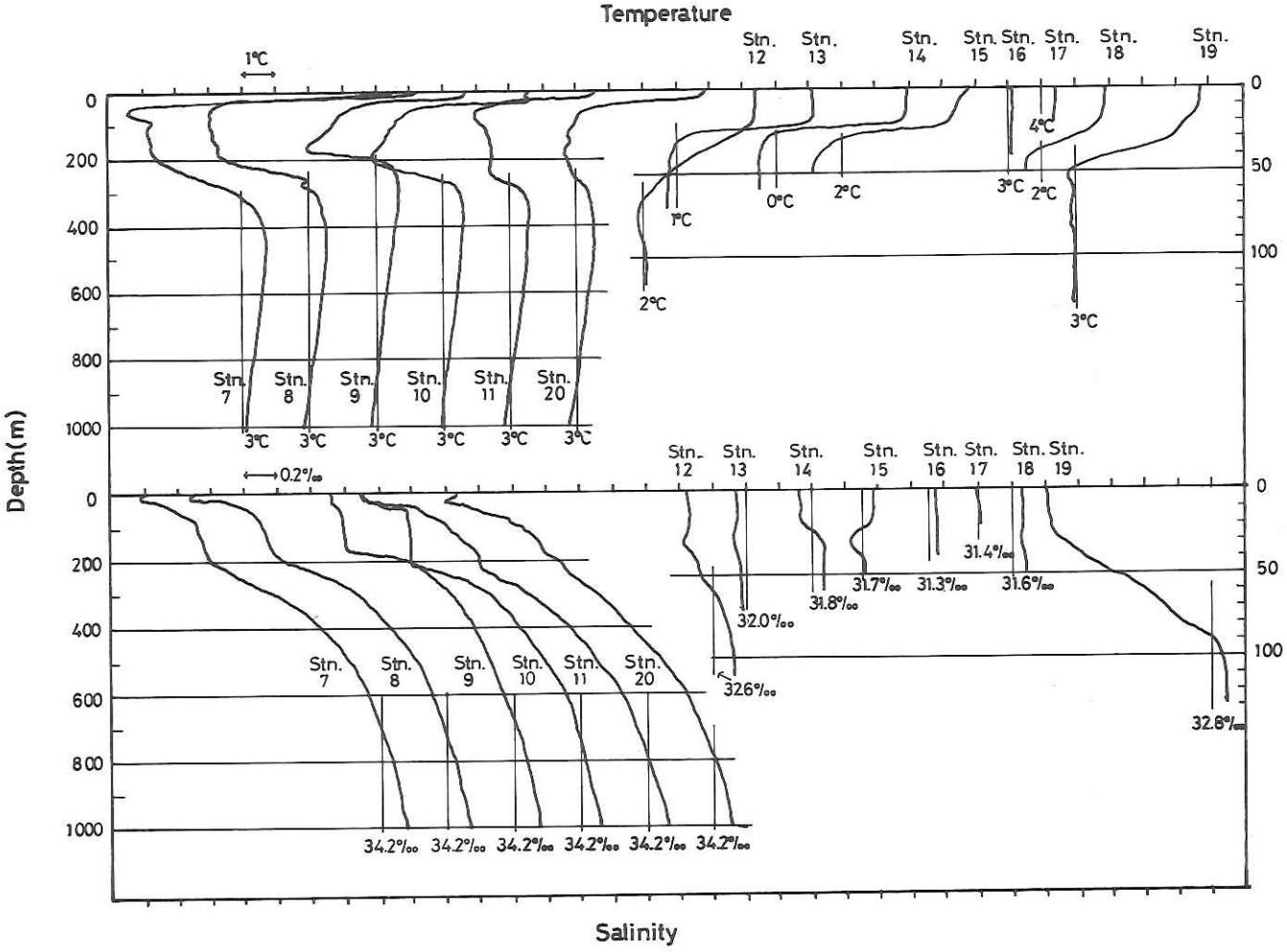

Fig. 12. Vertical profiles of temperature and salinity as measured by a Hytech STD system

Measurements of underwater irradiance and transparency

H. Otobe, T. Nakai and A. Hattori

The underwater irradiance was measured at 20 stations using an irradiance-meter, Model IU-2C ISHIKAWA TRADING CO., Ltd. Tokyo. The transparency was simultaneously determined with a Secchi disk. The depths of 50%, 25%, 10%, 1% and 0.1% light penetration, relative to the light in the surface, are presented in Table 35. To avoid error introduced by water turbulence near the surface, the surface values were estimated by extrapolating subsurface values (5-30 m) to 0 m in semilogarithmic plot.

Table 35. Submarine irradiance and transparency in the Bering Sea and the northern North pacific

Stations	Date Time	Location	Surface (lux)	50 %	25 %	10 %	1 %	0.1 %	Transp. (m)
				Depth (m)					
4	Jun. 29 11:36-11:55	49°38.9'N 158°02.0'E	73000	7	14	23	47	70	-
5	Jun. 30 08:18-08:26	52°00.4'N 162°00.6'E	15000	7	14	23	47	70	-
6	Jul. 1 11:07-11:20	54°31.3'N 164°26.6'E	91000	7	14	23	46	68	16
7-1	Jul. 3 07:16-07:45	56°56.8'N 167°05.3'E	65000	5	10	17	33	50	12
7-2	Jul. 4 11:14-11:25	57°00.0'N 167°04.7'E	11000	6	12	19	38	58	10
8	Jul. 5 08:43-08:52	57°00.2'N 170°55.6'E	19000	8	15	25	50	75	14
9	Jul. 6 11:50-11:58	57°00.2'N 174°52.4'E	31000	8	17	28	56	83	16
10	Jul. 7 12:35-12:48	57°02.6'N 179°05.8'E	22000	9	17	28	56	84	14
12	Jul. 9 10:30-10:38	57°01.2'N 172°28.0'W	45000	7	14	23	46	68	20
14	Jul. 10 13:25-13:35	56°59.2'N 165°31.5'W	34000	5	11	17	35	52	13
16	Jul. 11 08:03-08:07	58°16.8'N 164°55.1'W	14000	5	10	17	33	50	12
17	Jul. 11 17:07-17:15	59°30.8'N 166°58.3'W	16000	3	6	9	19	28	7
18	Jul. 12 07:10-07:17	58°16.8'N 167°01.3'W	8500	4	8	14	28	41	10
20	Jul. 13 12:08-12:30	55°01.6'N 168°01.3'W	11000	10	20	32	65	97	17
G-1	Jul. 17 08:16-08:23	52°07.8'N 161°01.5'W	9000	9	17	29	58	86	17
G-2	Jul. 18 10:53-11:05	49°58.8'N 155°00.7'W	21000	6	12	20	40	60	11
G-3	Jul. 19 08:10-08:24	49°57.5'N 151°38.9'W	8800	5	10	17	34	52	9
G-4	Jul. 20 08:25-08:34	50°00.6'N 144°28.7'W	31000	8	16	26	52	79	17
G-5	Jul. 21 08:10-08:16	49°54.5'N 138°48.1'W	17000	8	16	26	52	79	15
G-6	Jul. 22 08:08-08:22	49°20.3'N 131°20.8'W	17000	7	13	22	44	66	17

Measurements of radiation fluxes

H. Otobe

Fluxes of short- and long-wave solar radiation were continuously measured to assess the heat budget on the sea surface of the Bering Sea in summer. The short- and longwave sensors (Mole type thermopile, Eiko-Seiki-Sangyo Co., Ltd., Tokyo) with upward and downward components were installed on the observational bow-boom stuck out 4m from the top of the bow and 8m above the sea surface. The routine meteorological data were simultaneously collected.

Chemical and radiochemical studies of the North Pacific

S. Tsunogai, M. Minagawa, S. Konishi, M. Kusakabe,
T. Shinagawa and M. Nishimura

1. Chemical composition of particulate material in sea water.

Sea water samples collected at all hydrographic stations were filtered through a pre-weighed HA Millipore filter (pore size: 0.45) or a CPR Nuclepore filter (pore size: 0.4 μ)(47 mm in diameter). Duplicate or triplicate samples of particulate material were collected from each depth. The filters were washed with 3.5% ammonium carbonate, and dried at 30°C. The dry weight of particulate material was later determined as described elsewhere (Tsunogai, Minagawa and Arita, 1974).

Concentrations of Na, K, Mg, Ca, Cl, Si, Fe and P were determined by the methods as described by Tsunogai, Kido, Minagawa and Yamada (1973).

2. Size distribution of particulate material in sea water

With the same sea water samples (450 samples) as used for the dry weight determination, size distribution of particulate material was determined. The numbers of particles larger than 4 μ and smaller than about 100 μ were counted with a Model ZB Coulter

counter by dividing the size range into 15 fractions.

3. ^{210}Pb, ^{210}Po and ^{234}Th in particulate material

The usefulness of these nuclides as natural tracers to assess the behavior of particulate material in sea water has been discussed by Tsunogai, Nozaki and Minagawa (1974). At Stations 7, 11 and 30, about 90 l of seawater samples were collected from various depths and filtered through an HA Millipore filter. ^{210}Pb, ^{210}Po and ^{234}Th were chemically separated and their radioactivities were determined. High specific activities of ^{234}Th and ^{210}Po were found in particles collected from layers between 1000 and 1500 m at Station 30.

4. ^{226}Ra, ^{210}Pb and ^{234}Th in sea water

^{226}Ra seems to be a good tracer of the deep water movement. The deficiency of ^{210}Pb from ^{226}Ra activity in deep waters may indicate the particulate removal in the deep. We can also estimate the settling velocity of particulate material in the surface from the distributions of ^{234}Th and ^{210}Pb. We have devised an analytical method of these nuclides by using the same 20 - 30 l sample, which will be described elsewhere. Seawater samples were obtained (from various depths) at all the hydrographic stations.

5. Calcium in sea water

The calcium concentration in deep water increases gradually with time. The results on calcium together with data on alkalinity may be used to study the problems such as calcium carbonate dissolution, circulation of deep water, etc. Samples were collected at the hydrographic stations and will be analyzed by the method of Tsunogai, Nishimura and Nakaya (1968).

6. Chemical composition of bottom water

Samplings of bottom water were attempted at Stations 7, 11 and 30 with the aid of a sonar pinger. Unfortunately, we could succeed in obtaining samples only at Station 7. Nutrient concentrations of the bottom water were determined. Ca, Hg, ^{210}Pb, ^{234}Th, ^{226}Ra and other inorganic components in particulate material were

also determined.

7. Mercury in sea water, maritime air and maritime rain

The behavior of mercury in the earth's surface was investigated, 116 sea water samples (44 from the surface and 72 from various depths at 5 stations), 18 maritime rain samples were collected. Particulate material was obtained by filtering 5 - 10 l of sea water. Air samples were collected by bubbling 1 - 2 m^3 of the surface air through $KMnO_4$-H_2SO_4 solution. The mercury content will be determined by flameless atomic absorption spectroscopy (Nishimura, Matsunaga, Konishi, 1975).

8. Chemical and radiochemical studies of deep sea sediments

This work was performed as a part of integrated investigation on the cycling of chemical elements in the ocean and/or in the earth's surface. The migration of manganese in the deep sea sediments was specially emphasized. Collection of deep sea sediments were attempted at 5 stations using a piston core sampler. Sampling was successful at 3 stations. The following items were or will be determined:

a) Water contents (Table 36)

Sediment samples were dried at 110°C.

b) Ignition losses.

Sediments were heated at 450°C, for 3 hr.

c) Carbonate content.

d) Io-Th age determination.

e) U content and $^{234}U/^{238}U$ ratio.

f) ^{226}Ra and ^{210}Pb content -- Diffusion of Ra in sediments.

g) Mn and Fe in various forms in the sediments.

h) Estimate of diffusion rates of Ra in sediments by laboratory experiments.

i) P and Si contents in interstitial water (Table 37).

Interstitial water was obtained with a squeezer under a pressure of 1.5 - 2 atm with N_2 at room temperature.

Table 36. Water contents in sediments

Station 5		Station 7		Station 11	
depth (cm)	%	depth (cm)	%	depth (cm)	%
10 - 15	62	10 - 15	61	5 - 10	74
30 - 35	59	20 - 25	65	25 - 30	74
40 - 45	57	35 - 40	63	45 - 50	71
50 - 55	57	40 - 45	61	65 - 70	69
60 - 65	53	50 - 55	48	85 - 90	69
70 - 75	55	55 - 60	59	105 - 110	67
80 - 85	57	60 - 65	57	125 - 130	71
90 - 95	49	70 - 75	48	145 - 150	72
100 - 105	52	80 - 85	56	166 - 171	65
110 - 115	46	90 - 95	46	186 - 191	49
120 - 125	41	100 - 105	57	206 - 211	69
130 - 135	47	110 - 115	62	226 - 231	65
140 - 145	44	120 - 125	48	246 - 251	66
152 - 157	43	130 - 135	61	266 - 271	33
192 - 197	46	140 - 145	59	306 - 311	63
252 - 257	46	150 - 155	56	326 - 331	60
272 - 277	47	182 - 187	58	346 - 351	59
292 - 297	44	202 - 207	56	376 - 381	61
312 - 317	47	222 - 227	53	406 - 411	53
332 - 337	47	242 - 247	43	436 - 441	59
572 - 577	46	262 - 267	46	466 - 471	61
622 - 627	45	282 - 287	51	519 - 524	55
672 - 677	44	302 - 307	50	549 - 554	56
758 - 763	44	322 - 327	50	579 - 584	50
		345 - 350	44	609 - 614	54
		365 - 370	53	639 - 644	50
		405 - 410	48	669 - 674	22
		425 - 430	57	679 - 684	51
		445 - 450	54	694 - 699	52
		465 - 470	53	724 - 729	52
		485 - 490	29	754 - 759	27
		505 - 510	51	784 - 789	52
		579 - 584	42	814 - 819	24
		639 - 644	45	844 - 849	37
		669 - 674	48	854 - 859	38
		629 - 697	47	879 - 884	56
		742 - 747	45	909 - 914	52
		792 - 797	31	939 - 944	52
		842 - 847	46	969 - 974	55
		965 - 970	47	999 - 1004	54
		1053 - 1058	43		

Table 37. Concentrations of phosphate and silicate in interstitial waters

Station 5			Station 7			Station 11		
depth (cm)	P µg-atm/l	Si	depth (cm)	P µg-atm/l	Si	depth (cm)	P µg-atm/l	Si
10 - 15	9.2	992	10 - 15	22.7	937	0 - 5	12.5	971
20 - 25	6.5	910	20 - 25	15.9	906	10 - 15	12.2	966
30 - 35	8.5	956	30 - 35	14.4	1152	20 - 25	10.2	956
40 - 45	11.6	833	40 - 45	10.3	962	30 - 35	12.2	1001
50 - 55	8.0	703	50 - 55	11.4	973	40 - 45	19.3	1031
60 - 65	9.9	788	60 - 65	8.7	950	50 - 55	16.6	1001
70 - 75	10.9	820	70 - 75	5.4	898	60 - 65	18.4	999
80 - 85	9.9	828	80 - 85	7.3	908	70 - 75	15.0	923
90 - 95	5.7	659	90 - 95	1.9	744	80 - 85	17.0	981
100 - 105	33.7	684	100 - 105	6.8	890	90 - 95	20.3	974
110 - 115	13.4	708	110 - 115	6.2	861	100 - 105	17.8	944
			120 - 125	5.5	861	110 - 115	-	963
			130 - 135	6.6	824	120 - 125	19.2	954
			140 - 145	6.1	788	130 - 135	25.6	974
			150 - 155	6.0	827	140 - 145	22.6	955
			162 - 167	2.4	740	150 - 155	27.2	955
			182 - 187	9.5	767	161 - 166	22.3	894
			202 - 207	8.6	752	181 - 186	23.1	812
			222 - 227	8.9	749	201 - 206	31.2	907
			242 - 247	8.0	781	221 - 226	30.8	846
			262 - 267	11.6	661	241 - 246	35.3	942
			282 - 287	10.1	474	261 - 266	34.0	911
			302 - 307	16.3	744	281 - 286	42.1	935
			322 - 327	17.5	647	301 - 306	37.2	851
						321 - 326	46.5	926

j) Mn and other metals in interstitial water.

Aliquots of the interstitial water samples were reserved for the later determinations of metals with atomic absorption spectroscopy.

9. Nitrogen compounds in the atmosphere over the ocean.

The sources of the atmospheric nitrogen compounds and their flux were studied with the following samples.

a) Gaseous ammonia in maritime air

Ammonia in the surface air and aerosols was sampled during the cruise. The sampling was made only when the wind blew against the vessel. The sampling device was set on the bridge deck about 10 m above the sea surface. The air was sparged through a G-3 glass filter into 0.2 N sulfuric acid placed in three bottles connected in series. The air sampling was continued for 10 - 20 hrs at a flow rate of 0.5 - 1.0 l/min. The concentration of ammonia was determined by the oxidation method of Shinagawa and Tsunogai (unpublished). Only a few reliable data were obtained because of the low absorption efficiency and tail wind at the sampling.

b) Nitrogen compounds in aerosols

Aerosols in maritime air were collected by filtering air successively through a Millipore RA filter and a Millipore GS filter. The collectors were set on the bridge deck. The sampling was operated for 20-70 hrs at a flow rate of about 2 l/min. 30 samples were collected.

c) Nitrogen compounds in maritime rain

A rain water sampler with 0.6 m^2 surface area was set on the compass bridge deck. 33 samples were collected.

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Copper in sea waters

M. Mayeda

The distribution and behavior of copper in sea waters of highly productive areas of the northern North Pacific and the Bering Sea were investigated. 10 to 40 l of sea water samples were collected with Van Dorn polyethylene bottles.

Occurrence of copper : Twenty-three samples were collected at Stations 7, 11, 30 and 33. 3 l aliquots of the sea water samples were filtered through an HA Millipore filter as soon as possible. Their 500 ml portions were acidified with HNO_3 and the rest of them were frozen. The filtrates and the unfiltered sea water samples acidified with HNO_3 were brought back to the laboratory on land for further treatment. Total, reactive or organically bound copper will be determined.

To examine the effects of filtration, freezing and storage of sea waters on copper behavior, with selected samples, organically bound copper was extracted with chloroform on board ship. Reactive copper in unfiltered and/or filtered sea water samples was chelated with APDC at its native pH, and extracted with chloroform on board ship.

Change of copper concentration in bottled sea water : To study changes of total, reactive or organically bound copper with time,

18 sea water samples were collected from 0, 50, 100, 200, 500 and 1000 m at Stations 11, 30 and 33. 30 l of the sea water sample (10 l at Station 33) were poured into a polyethylene bottle without any pretreatment. At intervals of a day or two, 2.5 l portions were taken out from the bottle. 500 ml of each portion was acidified without filtration : the rest of them were filtered through an HA Millipore filter and acidified or frozen. The size distribution of particulate matter in the samples was simultaneously determined.

The copper content will be determined by means of flameless atomic absorption spectrophotometry.

Concentration of urea in sea waters

Y. Satoh

Aliquots of water samples collected with Nansen bottles were filtered through a Whatman type C glass fiber filter immediately after sampling, and the concentrations of urea were determined on board ship by the method of Newell et al. (1967). Duplicate analysis was carried out. Most of the samples were analyzed immediately after filtration, but some were stored frozen and then analyzed within a few days. The precision of the determination was $\pm$0.15 µg at.N/l .

Urea concentrations ranged from 0.31-1.65 µg at.N/l , averaged 0.75 in the Oyashio area (Stations 2-6), from 0.21-1.65 µg at.N/l , averaged 0.67, in the deep Bering Sea (Stations 7-11, and 20), from 0.38-1.61 µg at.N/l , averaged 0.81, in the continental shelf area (Stations 12-19), and from 0.32-1.67 µg at.N/l , averaged 0.64 in the northern North Pacific (Stations 26-35). The euphotic zone samples from the Gulf of Alasda (Stations G1 - G6) contained 0.43 -1.99 µg at.N/l , averaged 0.97.

The vertical profile of urea does not show any definite trend, although sometimes some peaks appeared. With 86 percent of all the

samples, urea concentration was less than 1.00 μg at.N/l ,

Reference

Newell, B. S., B. Morgan and J. Cundy (1967) J. Mar. Res. 25, 201-202.

Geochemical study on organic matter from marine sediment

N. Handa

Ocean floor sediments were collected with a piston corer at stations 5, 7 and 11. Interstitial water was obtained by squeezing the sedimentary samples. Interstitial water and sediment were analyzed for organic carbon and nitrogen, carbohydrate, amino acid, protein, lipid, hydrocarbon, humic acids and plant pigments to pursue early diagenetic change of organic matter in marine sediment.

Excretion of dissolved organic matter by zooplankton

N. Handa

Zooplankton were collected by an ORI conical net (160 cm mouth diameter, 750 cm in length, and 1.0 mm in mesh size) at Stations 8, 9, 12 and 26. Portions of the catch were suspended in fresh GF/C-filtered sea water to give population density of 30 individuals per 1 liter. The zooplankton were incubated in a glass bottle (10 liters) at 2°C for 30 min to 6 hr.

At intervals, 1 liter aliquots were withdrawn and filtered through a Whatman type C glass fiber filter. The fecal pellet of zooplankton collected on the filter was analyzed for chlorophyll pigments and organic composition. The filtrate was analyzed for various organic compounds, and the contribution of zooplankton excretion to the production of dissolved organic materials was evaluated.

^{13}C abundance in dissolved inorganic and particulate organic carbons

N. Handa

^{13}C content in carbonate and particulate organic matter in sea waters was measured to assess how much of total carbon dioxide in deep water is originated from the oxidation of organic matter.

The samples were collected from 31 water layers from the surface down to maximum 5,000 m depth at all of the stations where hydrocast with Nansen bottles was conducted. Immediately after the retrieval of the bottles, the sea water samples were transferred to glass bottles (250 ml). With their aliqouts, total carbon dioxide was determined by an IR method. Barium hydroxide solution was introduced to the sea water, and the bottles sealed tightly with paraffin and nylon tape to prevent the contamination of air. The isotopes were later determined in laboratory on land by the mass spectrometric method.

Photosynthetic production of organic constituents by marine diatoms

E. Tanoue, and N. Handa

Phytoplankton samples mainly consisted of diatoms (cf. Ishimaru and Nemoto, p. 76) were collected from the surface layer by towing the plankton net with NXX 18 nylon bolting cloth at Stations 6, 7 and 11. The phytoplankton were suspended in filtered sea water to give ca 10^5 cells/ml, and introduced into 250 ml or 1,000 ml glass bottles. $NaH^{14}CO_2$ was added and the bottles were incubated in the light (18 klux) or in the dark at 15°C for 2 hours. The reaction was stopped by the addition of formalin (0.5 % in final concentration). Phytoplankton were collected on a Whatman type C glass fiber filter, and stored in a freezer (-20°C) for later

analysis of ^{14}C distribution in various organic consitituents. Some incubated samples were stored without filtration, to examine the excretion of photosynthates.

Distribution of particulate organic matter and its decomposition processes in the marine environment

N. Handa and K. Matsunaga

Particulate matter was collected onto a Whatman type C glass fiber filter by filtration of sea water samples obtained from 24 water layers of the surface through 5000 m depth at Stations 7 and 11 in the Bering Sea and Station 30 in the northern North Pacific Ocean.

Organic carbon and nitrogen were determined by a CHN analyzer, Yanaco MT-IS (Tables 25-32). Carbohydrate, amino acid, protein, lipid and plant pigments were determined by spectrophotometric methods.

The decomposition rates of particulate organic matter were estimated from its vertical profiles by appling the diffusion-advection model and/or box model. The rates ranged from 60 to 80 $mgC/m^2 \cdot day$ at depth between 50 and 200 m.

Distribution of dissolved organic matter and its decomposition processes in the marine environment

K. Matsunaga and N. Handa

Three hundred ml of water samples collected from various depths at all of the stations where hydrocast with Nansen bottles was conducted were filtered through a Whatman type C glass fiber filter. The filtrates were allowed to stand in a freezer ($-20^{o}C$). Analyses were made for dissolved organic carbon and nitrogen,

carbohydrate, amino acid, protein, lipid and organic acids in the laboratory on land.

Sea water samples from Van Dorn sampler were fractionated using diaflow membranes (Amicon Co. Ltd.), and the molecular weight distribution of dissolved organic matter was examined.

The rates of assimilation and decomposition of dissolved organic matter was determined by ^{14}C tracer technique. ^{14}C-labeled acetic acid, glucose or starch was added to sea water samples from 20, 75 and 200 m depths. The reaction was ceased by the addition of mercuric chloride. Carbon dioxide was extracted by aeration and absorbed in ethyl cellosolve. The particulate matter was collected on an Millipore filter (HA). The Millipore filter was dissolved in scintillater (5 ml) and radioactivity was determined by a liquid scintillation counter in the laboratory on land.

Photosynthetic activity in the Bering Sea and the northern North Pacific

K. Satake, T. Saino and A. Hattori

Photosynthetic activity in the Bering Sea and the northern North Pacific Ocean was determined by a standard ^{14}C method (Strickland and Parsons, 1972). Water samples were collected with Van Dorn nonmetalic samplers from depths of 100 %, 50 %, 25 %, 10 % and 1 % of light penetration. The sample water (80 ml) was placed in glass bottle, and incubated together with 5 μCi of ^{14}C- $NaHCO_3$ in a tank exposed to artificial light (daylight fluorescent lamps) of about 10,000 lux for 3 hr. Neutral filters with 50, 25 and 10 % light transmission were applied to simulate natural light conditions. The samples were filtered through an HA Millipore filter, and radioactivity of particulate matter collected on the filter was counted with a GM gas flow counter, Aloka Super Scaler Model TDC-6. Results obtained are summarized in Table 38. Here, the data at maximum

depth represent the photosynthetic activity at a 100 % light intensity.

Reference

Strickland, J. D. H. and T. R. Parsons (1972)
A Practical Handbook of Seawater Analysis. Fisheries Research Board of Canada, Ottawa, p. 267.

Table 38. Photosynthetic activity ($mgC/m^3/hr$) in the Bering Sea and North Pacific

Station 2		Station 3		Station 4		Station 5		Station 6		Station 7	
0(m)	0.69	0	0.78	0	0.23	0	0.29	0	0.20	0	0.17
10	0.45			6	0.18	6	0.16	6	0.18	5	0.14
20	0.25			11	0.15	12	0.08	12	0.11	10	0.06
40	0.11			16	0.09	18	0.04	18	0.05	15	0.04
50	0.00			40	0.01	40	0.13	40	0.27	35	0.08

Station 9		Station 11		Station 14		Station 16		Station 18		Station G1	
0	0.16	0	0.40	0	0.58	0	0.22	0	0.35	0	0.03
10	0.16	5	0.27	11	0.42	5	0.26	3	0.27	8	0.03
20	0.08	10	0.25	18	0.22	10	0.15	6	0.20	17	0.01
30	0.03	15	0.10	36	0.28	15	0.08	12	0.10	23	0.01
75	0.05	30	0.08	55	0.56	33	0.27	27	0.54	56	0.02

Station G2		Station G3		Station G4		Station G5		Station G6	
0	0.17	0	0.50	0	0.20	0	0.30	0	0.22
7	0.35	7	0.41	18	0.16	10	0.19	10	0.11
14	0.35	14	0.37	27	0.07	20	0.10	19	0.11
19	0.10	19	0.14	60	0.05	30	0.06	29	0.17
46	0.07	46	0.09	90	0.08	66	0.12	64	0.06

Silicic acid uptake and regeneration in the North Pacific Ocean

J. J. Goering

Silicic acid consumption (uptake) and production (regeneration) were measured in the euphotic zone and just below at six (6) stations during late July 1975 in the North Pacific Ocean using the stable silicon isotope procedure (Goering et al, 1972; Nelson, 1975). At one station regeneration was measured at various depths down to 2000 m.

Detail of study

The rate of silica dissolution in surface seawater where silicic acid uptake occurs simultaneously was measured on Cruise KH-75-4 by a reverse labeling technique which employs ^{28}Si, the most abundant isotope of silicon, as a tracer. In this procedure ^{30}Si-labeled silicic acid is added to a sample of whole natural seawater and the isotopic composition of the total silicic acid pool (ambient plus added label) measured before and after an incubation. Dissolution of natural silica, containing silicon which is 92.18 atom % ^{28}Si, is measured as an increase in the ^{28}Si content of the dissolved silicic acid during the incubation period. Since dissolution is measured as a change in the isotopic composition rather than the total concentration of silicic acid the measurement is unaffected by biological uptake, which may alter the silicic acid concentration but is not isotopically selective. The procedure consists of three steps: incubation of a sample in the presence of ^{30}Si-enriched silicic acid, analysis of the initial and final isotopic composition of the silicic acid, and calculation of the dissolution rate from isotopic data. Since ^{30}Si-labeled silicic acid is added to the seawater initially, a simultaneous measurement of silicic acid uptake can be obtained by measuring the ^{30}Si content in the particulate material at the termination of incubation.

On Cruise KH-75-4 silicic acid consumption and regeneration were measured at six stations in water collected from the 100,

50, 15, 1 and .1 % light depths. After addition of ^{30}Si the water was placed into plexiglass containers that were wrapped with neutral density wire screens that simulated the above light levels. Incubation occured for 24 hours in a tank cooled with running surface seawater that was exposed to natural light. At one station an attempt to measure silicic production at various depths down to 2000 m (i.e., 150, 300, 500, 900, 1500 and 2000 m) was also completed.

Little information currently exists concerning the cycling of silicic acid in the surface water of the North Pacific Ocean. Results from the above measurements should, however, provide useful information concerning rates of consumption and production of silicic acid in the North Pacific.

References

Goering, J. J., Nelson, D. M. and Carter, J. A. (1973) Deep Sea Res, 20, 777-789.

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Studies on nitrogen metabolism of marine bacteria with special reference to denitrification and amino acid utilization

I. Koike and A. Hattori

1. Denitrification in the Bering Sea sediments

Denitrification activity was measured using a ^{15}N isotope method. Sediment samples were collected at Stations 12, 14 and 19 using a core sampler. With surface sediments (0 - 3 cm) the activity measurements were carried out within a few hours after sampling. The sediments (ca. 1 gram each) were placed in vacuum tight flasks. The flasks were filled with autoclaved sea water saturated with nitrogen gas, and ^{15}N-nitrate (50 % ^{15}N) was introduced. Effects of nitrate concentrations and incubation time on the activity were examined. After incubation, dissolved gas was extracted, and ^{15}N

content in nitrogen gas was determined by mass spectrometry. The concentrations of nitrate and nitrite in interstitial water were simultaneously determined.

Denitrification activity in the surface sediments of the eastern Bering Sea ranged 1.0 to 1.4 x 10^{-3} μg at.N/gram sediment/hr.

2. Amino acid metabolism in the surface water of the Bering Sea and North Pacific

Uptake and deamination of amino acids by microorganisms in the surface water were measured using ^{14}C- and ^{15}N- labeled glutamate, aspartate, lysine and glycine. 400 ml (for ^{15}N) or 200 ml (for ^{14}C) of sea water (Sta. 9, 20 m; Sta. 30, 20 m) was incubated for 4 hours in darkness. After incubation, particulate matter was collected by a Yumicron filter (0.40 μ, 25 mm). ^{15}N-ammonia in filtrate was separately collected in dilute HCl by steam distillation. ^{15}N content of particulate matter was measured by mass spectrometry.

After the acidification (pH 3.5) evolved CO_2 was absorbed in the mixture of ethanolamine and methyl cellosolve. Particulate matter was collected on a Yumicron filter (0.40 μ, 25 mm). Radioactivities in CO_2 and particulate matter were determined by a liquid scintillation counter and a gas flow counter, respectively.

Turnover rate of ammonia

H. Iizumi and A. Hattori

Turnover rates of ammonia in sea waters were measured with a ^{15}N isotope dilution technique. Samples were collected from the ammonia maximum layers (30 m) at Stations 7 and 11, and from 100 m at Station 7. ^{15}N labeled ammonia was introduced in 10 liters of sampled sea water so as to give several atomic percent excess of ^{15}N in ammonia. Incubation was carried out at 4-5°C in the dark. At intervals, 2 liter aliquots were removed and filtered through a Whatman type C glass fiber filter. The filters and filtrates were

stored under refrigeration for isotope analysis.

Nutrient analysis of interstitial waters

H. Iizumi, I. Koike and A. Hattori

Core samples were collected with a pilot corer attached to the lever of a piston corer at Stations 5, 7, 11 and 33. A Phleger core sampler was used at Stations 12, 14 and 17. Interstitial waters were expressed with a gas-operated squeezer (Reeburgh, 1967) within 2 hours after sampling, and kept frozen until use. Ammonia was determined by the method of Solorzano (1969) after dilution with low ammonia sea water, nitrite by the method of Bendschneider and Robinson (1952) after dilution with deionized water, and nitrate by the method of Wood, Armstrong and Richards (1967) as modified for small volume of sample. C and N contents of sediments were determined by a Yanagimoto MT-1 CHN analyzer.

References

Bendshneider, K. and R. J. Robinson (1952) J. Mar. Res., 11, 87.

Reeburgh, W. S. (1967) Limnol. Oceanogr., 12, 163.

Solorzano, L. (1969) Limnol. Oceanogr., 14, 789.

Wood, E. D., F. A. Armstrong and F. A. Richards (1967) J. Mar. Biol. Ass. U. K., 47, 23.

Estimate of the *in situ* growth rate of phytoplankters in the northern North Pacific and the Bering Sea

T. Saino and A. Hattori

Experiments to measure the *in situ* growth rate were carried out with surface waters collected at Stations 5, 7, 9, 11, 14, G1, G2, G3 and G4.

Surface waters, filtered through net cloth (0.3 mm mesh) to eliminate the larger zooplankters, were introduced into 5-liter glass bottles and incubated in a deck incubator cooled by surface water under natural sun light. Aliquots were taken out once a day for 3 to 4 days. At the end of experiments, remaining samples were filtered through a preheated Whatman type C glass fibre filter, and particulate matter was collected.

Concentrations of particulate matter (4-64 μ^3) in the subsamples were measured by a Coulter counter (Model ZB, 200 μm aperture). Aliquots of the subsamples were simultaneously fixed with neutralized formalin or glutalaldehyde.

Growth rates of the phytoplankters were estimated from
(1) cell number, counted by microscopic observation,
(2) volume of the particulates, determined by a Coulter counter, or
(3) concentration of carbon or nitrogen in the particulate matter.

Growth rates thus obtained are compared with those estimated from uptake rates of CO_2, $NH_4^+ + NO_3^-$ and SiO_2.

Acetylene reduction in the northern North Pacific and the Bering Sea

T. Saino and A. Hattori

Acetylene reduction was measured at 4 stations in the northern North Pacific and 3 stations in the Bering Sea.

Surface waters were filtered through net cloth (0.3 mm mesh) immediately after sampling, and introduced into 5 l glass bottles. Acetylene gas (Product of Matheson Co.) was introduced into 1 l. of gas space to yield its partial pressure of 0.1 atmosphere. The bottles were incubated in a deck incubator cooled by surface water under natural sun light. Aliquots of gas were withdrawn with vacutainers once a day for several days. Control experiments were run in the presence of 0.1 mM $HgCl_2$.

No acetylene reducing activity was detected.

Downward transport of particulate matter into deep water

K. Iseki and S. Nishizawa

There is convincing evidence (Nakajima, 1971; Ichikawa, 1975) to show that the concentration of particulate organic matter in deep layers of the open sea is positively correlated, on a broad scale, with the concentration in the overlying surface layer observed simultaneously. The correlation has so far been confirmed to be highly significant at least down to 2000 m depth for the data obtained from more than 20 localities of the entire Pacific and adjacent seas among which the average surface concentration varied from 20 to 300 μgC/l. This suggests that the actual transport of organic particles into deep layers has to be quite rapid compared with the slow processes as supposed so far from experimentally determined sinking rates of living phytoplankton and small particles. The sinking of large particles such as fecal pellets, zooplankton carcasses, molts and other aggregates would probably provide an important mechanism for the rapid transport. This would contribute a major fraction of the total flux because of its rapidity and large mass per particle although these particles are caught only rarely by the routine water sampling procedure (McCave, 1975).

We designed in situ particle collectors (Fig. 13) and suspended them deep in the water during this cruise to test the above hypothesis. The collector used is a polyethylene bottle about 1 m long with a wide mouth 50 cm in diameter. At the bottom of the collector is connected a glass bottle containing a formalin solution to prevent bacterial decomposition of collected particles during the suspension. The collector is equipped with a lid-cover which is opened while lowered and is closed before upheaval by a tripping messenger system triggered by an electric time releaser.

The collections were performed at Stations 7, 14 and 27 (Table 39), and 2 - 4 collectors were arrayed on a mooring system (Fig. 14) together with the current meters which Dr. K. Takano took charge of.

Samples collected from about 1600 - 1800 m depth at Stations 7 and 27 revealed green color and contained considerable amounts of large fluffy particles including fecal pellets.

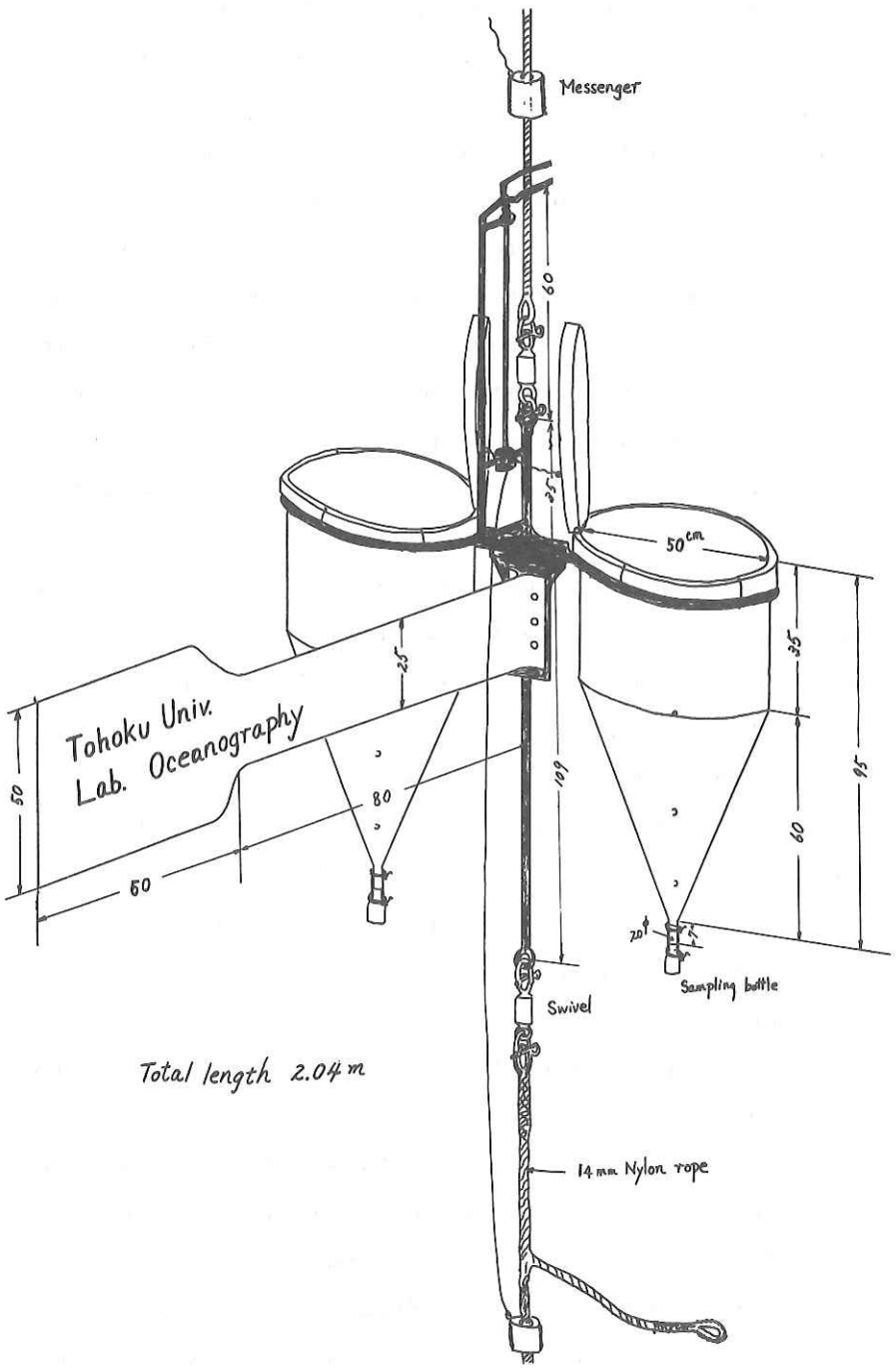

Fig. 13. In situ particle collector

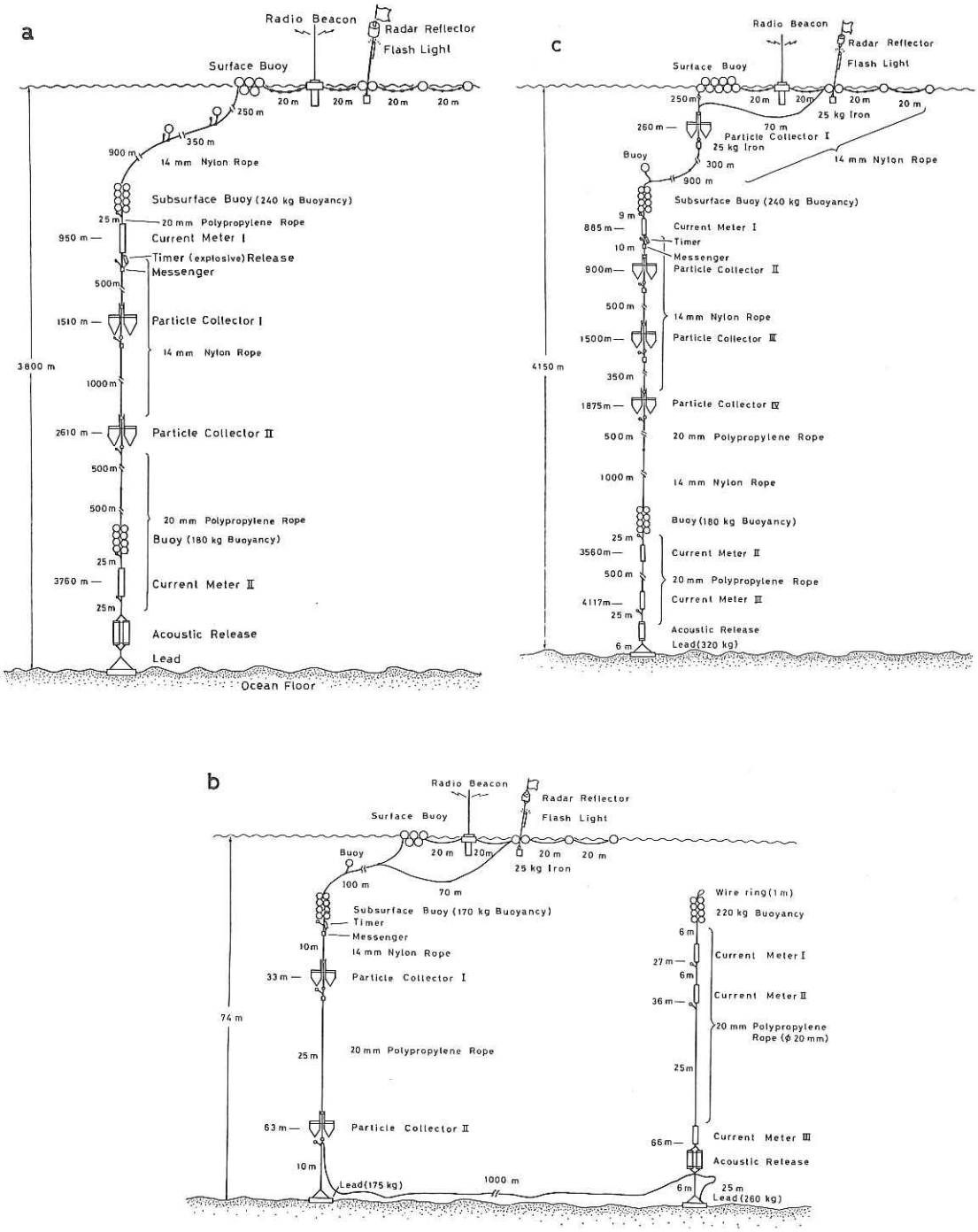

Fig. 14. Moring arrangements. a: at Station 7; b: at Station 14; c: at Station 27

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McCave, I. N. 1975. Vertical flux of particles in the ocean. Deep-Sea Res. 22: 491 - 502.

Table 39. Particle collector record

Sta.	Date	Collection time (hr)	Location Lat.	Location Long.	Sampling depth (m)	Bottom depth (m)
7	July 2 July 4	47	56°59.1'N	167°00.8'E	1510 2610	3800
14	July 9 July	54	56°58.8'N	165°36.5'W	33 63	74
27	July 20 Aug. 3	307	50°00.8'N	144°29.8'W	260 900 1500 1875	4150

Distribution of phytoplankton

T. Ishimaru and T. Nemoto

Phytoplankton were collected by vertical haul of NORPAC net (xx13) from 150 m to the surface, and by Van Dorn bottles from predetermined depths between the surface and 200 m. The collected samples were immediately fixed with 10 or 2 % neutralized formalin. Population of macrophytoplankton was examined with net-collected

samples. The water samples were filtered through a HA Millipore filter, and microphytoplankton collected on the filter were dried at 60°C. The Millipore filters were treated with Nikon immersion oil to make transparent and specific composition and population densities of phytoplankton were examined under a phase contrast microscope (Table 40). According to Tsuji et al. (1976), water samples were also fixed with glutaraldehyde, and microphytoplankton were collected on a German TCM 450 filter to examine naked flagellates. The filters were immediately processed with glycelin and gelatin to facilitate microscopic inspection. Generally, diatoms were abundant at all stations. This was especially the case with the waters east of Kamchatka peninsula (Stations 5, 6, 7 and 8.). Chaetoceros convoltus, Denticula sp., Nitzschia seriata, Thalassiosila decipiens, Rhizosolenia alata, and Rh. hebetata were widely distributed. Benthic diatoms such as Melosira sulcata and Navicula sp. were found in Bristol Bay.

High population densities of coccolithophorids were found in Gulf of Alaska and its adjacent areas (Stations 26, G3, G4, G5, G6 and 30). Their morphological investigation, using a scanning electron microscope, is now in progress.

Reference

Tsuji, T., Y. Yokota and T. Yanagida (1976).
Proceeding of 1976 Spring Meeting of Oceang. Soc. Japan, 96.

Table 40. Cell number of phytoplankton per milli-litre

	Sta. 2			Sta. 3	Sta. 4			Sta. 5			Sta. 6			Sta. 7		
	0 m	20 m	50 m	0 m	0 m	20 m	50 m	0 m	20 m	50 m	0 m	20 m	50 m	0 m	20 m	50 m
Diatoms																
total number of diatoms	54.6	46.0	18.1	52.8	27.5	26.8	162.7	97.8	173.5	44.3	133.6	170.1	133.1	123.8	29.0	5.2
Asteromphalus sp.	0.5	0.3	-	-	-	-	-	0.3	0.9	-	0.5	-	-	-	0.4	-
Biddulphia aurita (Lyngbye) Brevisson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaetoceros atlanticus Cleve	-	0.6	-	0.6	-	-	-	-	2.8	0.5	2.5	5.1	-	-	-	-
Ch. convoltus Castracane	0.1	-	-	-	0.6	-	0.1	35.8	19.4	1.9	7.6	7.1	6.1	2.5	0.1	-
Ch. compressus Lauder	-	-	-	-	-	-	-	8.9	7.0	0.6	-	-	-	-	-	-
Ch. debilis Cleve	-	-	-	-	17.8	14.2	-	-	2.5	4.4	-	-	-	-	-	-
Ch. didymus Ehrenberg	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-
Ch. furcellatus Bailey	-	-	-	-	1.8	-	143.8	2.5	0.6	3.2	-	-	-	-	-	-
Ch.-Hyalochaeta spp.	-	-	1.9	1.8	-	-	11.2	-	-	-	5.1	-	39.6	11.2	1.6	0.5
Corethron hystrix Hensen	-	-	-	-	0.1	0.1	-	1.5	0.9	0.1	0.5	1.5	-	-	-	-
Coscinodiscus asteromphalus Ehrenberg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cos. debilis Grove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cos. marginatus Ehrenberg	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denticula sp.	35.8	26.7	8.1	37.3	-	-	2.3	4.6	34.8	3.4	47.8	64.0	29.0	4.1	2.0	1.9
Melosira sulcata (Ehrenberg) Kützing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Navicula spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitzschia seriata Cleve	0.6	1.1	0.6	9.1	4.3	8.3	2.8	26.7	86.2	25.8	54.9	77.2	54.4	100.5	15.2	1.7
N. delicatissima Cleve	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pleurosigma sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhizosolenia alata Brightwell	0.5	0.4	-	-	1.9	-	-	2.5	5.3	-	7.6	6.1	1.5	2.0	0.1	-
Rh. hebetata Gran	1.0	0.3	-	0.3	0.5	0.1	-	3.6	1.5	-	0.5	-	-	-	0.3	-
Thalassionema nitzschioides Grunow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thalassiosira decipiens (Grunow) Jörgensen	14.9	15.5	7.5	3.3	0.2	4.0	2.2	7.4	9.9	3.9	4.1	6.6	2.5	2.5	8.3	1.1
Thalassiothrix longissima Cleve & Grunow	0.9	0.6	-	0.4	0.3	0.1	0.3	3.6	1.3	0.5	0.5	2.5	-	0.5	1.0	-
Tropidoneis sp.	0.3	0.4	-	-	-	-	-	0.4	0.4	-	-	-	-	0.5	-	-
Dinoflagellates																
Certium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peridinium spp.	-	-	-	-	0.1	0.3	-	-	0.1	-	-	-	-	-	-	-
Dinophysis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coccolithophorids																
total number of coccolithophorids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sillicoflagellates																
Distephanus speculum (Ehrenberg) Haeckel	0.4	0.6	0.1	0.3	0.1	-	-	0.3	0.8	0.1	-	-	0.5	-	-	-

	Sta. 8			Sta. 9			Sta. 10			Sta. 11			Sta. 12		
	0 m	20 m	50 m	0 m	20 m	50 m	0 m	20 m	50 m	0 m	20 m	50 m	0 m	20 m	50 m
Diatoms															
total number of diatoms	101.4	97.1	2.0	28.5	2.4	13.1	12.9	17.0	7.8	16.2	22.1	11.7	36.9	4.7	5.8
Asteromphalus sp.	0.3	0.8	-	4.1	0.3	-	0.7	0.5	0.4	-	0.1	-	-	-	-
Biddulphia aurita (Lyngbye) Brevisson	-	-	-	-	-	-	-	-	-	-	-	0.9	-	-	-
Chaetoceros atlanticus Cleve	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. convoltus Castracane	6.6	7.4	0.1	-	0.3	0.3	0.1	-	-	0.4	-	-	-	-	-
Ch. compressus Lauder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. debilis Cleve	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. didymus Ehrenberg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. furcellatus Bailey	-	-	-	-	-	-	-	-	1.3	-	-	-	-	0.4	-
Ch.-Hyalochaeta spp.	92.5	87.6	0.8	-	-	-	-	-	-	0.1	3.5	1.3	-	-	-
Corethron hystrix Hensen	-	-	-	-	-	-	0.3	0.3	-	-	0.1	0.1	0.3	-	-
Coscinodiscus asteromphalus Ehrenberg	-	-	-	-	-	-	0.1	0.3	0.1	0.1	-	-	-	-	-
Cos. debilis Grove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cos. marginatus Ehrenberg	-	-	-	-	-	-	0.2	-	-	0.1	-	-	-	-	-
Denticula sp.	-	1.3	0.8	3.6	0.4	2.2	9.5	13.8	1.9	1.3	2.2	2.4	10.2	0.5	0.8
Melosira sulcata (Ehrenberg) Kützing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Navicula spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitzschia seriata Cleve	2.0	-	-	8.1	0.4	3.0	-	-	-	-	4.7	1.3	4.8	-	0.8
N. delicatissima Cleve	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pleurosigma sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhizosolenia alata Brightwell	-	-	-	-	-	-	-	-	-	1.9	7.0	2.2	2.5	1.5	1.3
Rh. hebetata Gran	-	-	-	-	-	-	0.3	0.1	0.3	11.2	3.4	2.0	15.9	1.8	1.8
Thalassionema nitzschioides Grunow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thalassiosira decipiens (Grunow) Jörgensen	-	-	0.3	12.7	1.0	7.6	1.4	1.6	3.7	1.1	1.0	1.5	3.2	0.4	1.1
Thalassiothrix longissima Cleve & Grunow	-	-	-	-	-	-	0.3	0.4	0.1	-	-	-	-	-	-
Tropidoneis sp.	-	-	-	-	-	-	-	-	-	-	0.1	-	-	0.1	-
Dinoflagellates															
Certium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peridinium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinophysis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Coccolithophorids															
total number of coccolithophorids	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	0.1
Sillicoflagellates															
Distephanus speculum (Ehrenberg) Haeckel	-	0.3	-	-	-	0.7	-	-	0.1	-	-	-	-	-	-

	Sta. 13			Sta. 14			Sta. 15			Sta. 16			Sta. 17		
	0 m	20 m	50 m	0 m	20 m	50 m	0 m	20 m	50 m	0 m	10 m	30 m	0 m	10 m	28 m
Diatoms															
total number of diatoms	21.6	7.4	2246.6	58.5	62.7	33.6	35.8	53.9	13.0	40.7	46.0	29.2	14.3	21.8	22.7
Asteromphalus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biddulphia aurita (Lyngbye) Brevisson	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-
Chaetoceros atlanticus Cleve	0.6	0.9	12.7	-	-	-	-	-	-	-	-	-	-	-	-
Ch. convoltus Castracane	15.0	5.2	-	57.7	62.7	30.2	32.5	12.2	-	-	12.4	-	-	0.5	-
Ch. compressus Lauder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. debilis Cleve	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. didymus Ehrenberg	-	-	-	-	-	-	-	-	-	-	19.3	-	-	-	-
Ch. furcellatus Bailey	0.6	0.5	2115.8	-	-	-	-	1.3	3.8	-	-	-	-	-	-
Ch.-Hyalochaeta spp.	-	-	-	-	-	-	-	-	3.3	38.1	4.6	15.7	-	-	-
Corethron hystrix Hensen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coscinodiscus asteromphalus Ehrenberg	-	-	1.3	-	-	0.8	-	-	0.8	-	-	-	-	0.5	0.5
Cos. debilis Grove	-	-	-	-	-	0.3	-	-	-	-	0.3	1.0	6.9	10.9	13.0
Cos. marginatus Ehrenberg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denticula sp.	3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melosira sulcata (Ehrenberg) Kützing	-	-	-	-	-	-	-	-	3.8	-	9.1	3.0	4.8	3.5	6.9
Navicula spp.	-	-	-	-	-	-	-	-	-	-	-	1.0	0.2	1.3	0.3
Nitzschia seriata Cleve	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. delicatissima Cleve	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pleurosigma sp.	-	-	-	-	-	-	-	-	-	-	-	0.3	1.9	5.1	2.0
Rhizosolenia alata Brightwell	0.1	0.3	2.5	-	-	-	3.3	27.4	-	-	0.3	0.8	-	-	-
Rh. hebetata Gran	0.8	-	-	0.8	-	-	-	13.0	-	0.1	-	1.0	-	-	-
Thalassionema nitzschioides Grunow	-	-	-	-	-	-	-	-	-	2.5	-	6.1	-	-	-
Thalassiosira decipiens (Grunow) Jörgensen	-	0.5	114.3	-	-	2.3	-	-	0.8	-	-	0.3	0.5	-	-
Thalassiothrix longissima Cleve & Grunow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tropidoneis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinoflagellates															
Certium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peridinium spp.	0.6	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-
Dinophysis spp.	-	-	-	0.5	-	-	0.8	0.3	-	0.3	-	-	-	-	-
Coccolithophorids															
total number of coccolithophorids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sillicoflagellates															
Distephanus speculum (Ehrenberg) Haeckel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3

	Sta. 18			Sta. 19			Sta. 20			G1	Sta. 26 (G2)			G3	G4
	0 m	20 m	50 m	0 m	20 m	50 m	0 m	20 m	50 m	0 m	0 m	20 m	50 m	0 m	0 m
Diatoms															
total number of diatoms	132.8	75.7	119.2	25.3	32.3	18.5	37.0	31.0	3.5	35.8	48.1	35.2	34.0	285.6	3.5
Asteromphalus sp.	-	-	-	-	-	-	-	-	-	-	-	0.3	0.5	0.3	-
Biddulphia aurita (Lyngbye) Brevisson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaetoceros atlanticus Cleve	-	-	-	-	-	-	0.5	0.3	-	-	-	-	0.5	6.1	-
Ch. convoltus Castracane	14.7	16.3	59.2	-	-	1.3	0.3	0.3	0.1	5.5	0.8	3.3	0.3	5.6	0.2
Ch. compressus Lauder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. debilis Cleve	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. didymus Ehrenberg	-	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch. furcellatus Bailey	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ch.-Hyalochaeta spp.	116.8	56.1	55.4	20.0	29.5	5.8	26.2	20.1	1.8	-	-	-	-	-	-
Corethron hystrix Hensen	-	-	-	-	-	-	-	-	-	0.1	0.3	-	0.3	-	-
Coscinodiscus asteromphalus Ehrenberg	0.2	0.2	0.8	-	-	-	-	-	-	-	-	-	-	-	-
Cos. debilis Grove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cos. marginatus Ehrenberg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denticula sp.	-	-	-	-	-	-	-	-	0.3	11.6	1.0	0.8	4.8	33.8	-
Melosira sulcata (Ehrenberg) Kützing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Navicula spp.	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-
Nitzschia seriata Cleve	-	-	-	-	-	-	-	-	-	16.6	38.4	25.4	24.6	225.8	1.0
N. delicatissima Cleve	-	-	-	-	-	5.8	-	-	-	-	-	-	-	-	-
Pleurosigma sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhizosolenia alata Brightwell	0.3	0.3	-	0.3	0.5	0.5	0.8	-	0.3	1.0	0.5	0.3	0.5	0.5	1.8
Rh. hebetata Gran	0.3	-	-	-	-	-	1.0	0.5	-	-	-	-	-	-	-
Thalassionema nitzschioides Grunow	-	-	-	5.0	2.3	5.1	-	-	-	-	-	-	-	-	-
Thalassiosira decipiens (Grunow) Jörgensen	-	-	3.0	-	-	-	8.2	6.8	0.9	1.0	7.1	5.1	2.0	11.7	0.5
Thalassiothrix longissima Cleve & Grunow	0.5	-	-	-	-	-	-	3.0	0.1	-	-	-	0.5	1.8	-
Tropidoneis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinoflagellates															
Certium spp.	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-
Peridinium spp.	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-
Dinophysis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coccolithophorids															
total number of coccolithophorids	-	-	-	-	-	-	-	-	-	-	133.3	94.2	22.6	70.7	33.5
Sillicoflagellates															
Distephanus speculum (Ehrenberg) Haeckel	-	-	-	-	-	-	0.8	0.5	0.1	-	-	-	0.3	-	-

	G5	G6	Sta. 30			Sta. 33			Sta. 35
	0 m	0 m	0 m	20 m	50 m	0 m	20 m	50 m	0 m
Diatoms									
total number of diatoms	11.5	26.2	0.5	5.4	2.4	8.9	9.5	15.2	28.3
Asteromphalus sp.	-	-	-	-	-	-	0.1	0.1	-
Biddulphia aurita (Lyngbye) Brevisson	-	-	-	-	-	-	-	-	-
Chaetoceros atlanticus Cleve	-	-	-	-	0.3	0.8	0.4	0.4	-
Ch. convoltus Castracane	-	-	0.3	0.5	0.3	0.3	0.4	0.6	9.1
Ch. compressus Lauder	-	-	-	-	-	-	-	-	-
Ch. debilis Cleve	-	-	-	-	-	-	-	-	-
Ch. didymus Ehrenberg	-	-	-	-	-	-	-	-	-
Ch. furcellatus Bailey	-	-	-	-	-	-	-	-	-
Ch.-Hyalochaeta spp.	-	-	-	-	-	-	-	-	-
Corethron hystrix Hensen	0.1	-	0.1	0.3	-	-	-	-	-
Coscinodiscus asteromphalus Ehrenberg	-	-	-	-	-	-	-	-	-
Cos. debilis Grove	-	-	-	-	-	-	-	-	-
Cos. marginatus Ehrenberg	-	-	-	-	-	0.3	0.1	-	-
Denticula sp.	1.7	-	-	3.3	-	3.8	2.2	2.7	8.1
Melosira sulcata (Ehrenberg) Kützing	-	-	-	-	-	-	-	-	-
Navicula spp.	-	-	-	-	-	-	-	-	-
Nitzschia seriata Cleve	8.3	15.8	-	-	-	1.5	4.6	9.5	7.6
N. delicatissima Cleve	-	-	-	-	-	-	-	-	-
Pleurosigma sp.	-	-	-	-	-	-	-	-	-
Rhizosolenia alata Brightwell	0.8	8.3	0.1	1.0	1.0	0.2	0.6	1.3	0.5
Rh. hebetata Gran	-	0.8	-	-	0.3	-	-	-	-
Thalassionema nitzschioides Grunow	-	-	-	-	-	-	-	-	-
Thalassiosira decipiens (Grunow) Jörgensen	0.6	1.3	-	0.3	0.5	1.4	1.0	0.5	3.0
Thalassiothrix longissima Cleve & Grunow	-	-	-	-	-	0.3	0.1	0.1	-
Tropidoneis sp.	-	-	-	-	-	0.3	-	-	-
Dinoflagellates									
Certium spp.	-	-	-	-	-	0.3	0.3	-	-
Peridinium spp.	-	-	-	-	-	-	-	-	-
Dinophysis spp.	-	-	-	-	-	-	-	-	-
Coccolithophorids									
total number of coccolithophorids	15.5	97.0	8.1	69.8	10.2	3.3	1.4	1.3	1.0
Sillicoflagellates									
Distephanus speculum (Ehrenberg) Haeckel	-	-	-	-	0.5	-	-	0.3	-

Studies on zooplankton and micronekton

T. Nemoto and T. Ishimaru

Following sampling methods were adopted to collect zooplankton and micronekton in the Bering Sea and its adjacent waters:

Water bottle sampling for ultraplankton,
NORPAC net sampling for general zooplankton,
MTD net sampling for macrozooplankton,
ORI net sampling for macrozooplankton and micronekton,
IKMT net sampling for micronekton, and
Neuston net sampling for neuston.

The biomass of zooplankton, macrozooplankton and micronekton were measured (Table 41). Pisces micronekton biomass was extremely high in the Bering Sea. Two myctophids, Stenobranchius leucopsarus and S. nonnachir, were dominant species. Pelagic shrimps, mysids and euphausiids were also other important components in micronekton. However, they showed more local differences in abundance.

The feeding behavior of micronekton was examined. Euphausiids mainly feed on phytoplankton at night. On the other hand, mesopelagic mysids take detritus. Pelagic shrimps which come up the epipelagic zone feed on copepods.

The food and feeding structures of micronektonic fishes were studied on board ship. The weights of stomach contents and species of food items were examined. The most of Myctophids feed on zooplankton. The active migrants, Stenobranchius leucopsarus, and S. nonnachir are feeding mainly on Calanus plumchrus and ostracods in the epipelagic zone. The weights of stomach contents amount about up to 3 %, which is considerably higher than the results obtained for myctophids in other areas. Chauliodus sp. takes large prey of fish up to 7 % of body weight. There are clear diurnal rhythm in feeding, namely these micronektonic fishes usually take their food at night.

Table 41. Biomass (wet weight, g/1,000 m^3) of micro-nekton collected by KH-75-4 Cruise

Station no.	Depth (m)	Fish	Pelagic shrimps	Mysids	Euphausiids	Copepods	Amphipods	Chaetognaths	Pelagic squids	Anomuran decapods	Polychaetes
3	640	0.78	0.58	0.15	2.31	+	0.15	0.08	0.06	-	+
3	1,400	2.38	0.48	0.24	0.27	-	0.02	-	0.11	+	--
4	700	3.69	0.66	0.03	0.68	0.03	0.02	0.13	0.01	-	--
6	600	1.66	1.05	0.13	0.99	0.01	0.02	0.04	0.14	+	-
7	520	3.39	0.04	0.07	0.35	0.08	0.04	0.06	0.04	-	0.01
7	1,400	1.17	0.52	0.43	0.11	0.02	0.01	0.01	+	-	+
8	570	3.18	0.13	0.14	0.15	0.11	0.03	0.04	0.03	-	+
10	520	2.02	0.02	0.02	0.10	0.05	0.03	0.03	0.05	-	+
11	450	8.21	0.73	0.16	2.08	0.02	0.04	0.04	0.03	-	0.01
11	960	1.63	0.61	0.39	0.04	0.01	0.02	0.01	0.03	-	+
12	45	-	-	-	-	-	0.05	-	-	-	-
20	630	3.08	0.08	0.18	0.85	0.01	0.02	0.02	0.02	-	-
26	720	1.46	0.41	0.11	0.04	-	0.02	0.01	0.04	-	+
27	590	2.72	0.25	0.11	0.56	+	0.03	0.12	0.03	-	-
33	1,000	1.32	0.55	0.28	0.16	0.09	-	0.11	0.31	-	0.01

Ecological study of zooplankton and neuston in the subarctic waters of the Pacific Ocean

T. Tsujita and M. Kamba

Zooplankton and larval fishes were collected from very surface and subsurface layer to investigate the community structure of neuston with special reference to specific composition, biomass and its circadian changes in the Bering Sea and the northern North Pacific Ocean.

Neuston samplings were carried out using a specially designed two-stage neuston net (20x40 cm rectangular mouth, 260 cm netting with 0.33 mm mesh opening) (Fig. 15). Neuston samples from 0-10 cm and 10-30 cm layers were separately collected. The net was towed at a speed of 1.5 to 2 knots for 10 minutes. The sampling were made at 15 stations in the Bering Sea and the northern North Pacific Ocean.

MTD nets were simultaneously towed at depths of 0, 5, 10, 30, 50 and 100 m. The net tows were repeated three to five times a day to obtain information for vertical migration of zooplankton. The plankton samples obtained were preserved in 5-10 % neutral formalin seawater. Wet weight of the samples collected by MTD nets was measured on board ship and expressed in gram wet weight per a haul (Table 42).

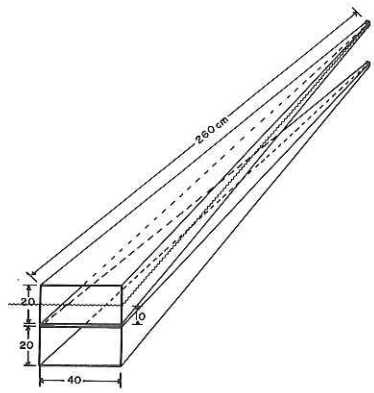

Fig. 15. Neuston net used

Table 42. Data on zooplankton samplings by neuston net and MTD net

Sta. No.	Date	Time	Location		Wet weight per a haul (gr.)					
			Net in	Net out	0 m	5 m	10 m	30 m	50 m	100 m
4	June 29	0954-1004	49-38.9N 157-01.9E	49-38.4N 158-00.7E	199.2	604.7	221.9	101.8	58.7	10.2
5	June 30	0550-0600	51-59.8N 161-59.6E	52-00.1N 162-00.7E	102.1	107.6	5.0	27.9	198.2	87.1
6	July 1	2024-2034	54-35.9N 164-45.2E	54-36.8N 164-34.1E	84.1	108.1	31.5	76.9	35.4	17.9
7	July 3	0651-0701	56-56.8N 167-05.1E	56-56.8N 167-05.3E	29.6	123.9	54.2	75.2	52.9	27.2
7	July 3	1348-1358	56-58.1N 167-08.3E	56-58.1N 167-07.2E	24.3	18.0	46.9	40.2	35.4	15.4
7	July 3	2106-2116	56-58.5N 167-05.1E	56-58.4N 167-04.6E	73.0	86.0	58.5	48.6	22.3	No sample
7	July 4	0213-0223	56-58.5N 167-09.9E	56-58.4N 167-09.3E	36.8	95.0	72.5	53.8	6.2	14.5
7	July 4	0738-0748	56-59.2N 167-08.9E	56-59.3N 167-07.5E	31.3	47.8	28.7	44.2	39.0	39.2
8	July 5	1220-1230	57-00.2N 171-03.1E	57-00.0N 171-04.8E	6.3	11.4	86.3	135.9	97.5	24.1
9	July 6	1342-1352	56-59.9N 174-53.3E	56-59.8N 174-53.6E	1.6	2.8	4.3	50.2	14.0	9.2
10	July 7	1522-1532	57-01.6N 179-14.7E	57-01.8N 179-15.3E	25.9	99.2	53.6	67.1	46.1	13.4
11	July 7'	0335-0345	57-02.2N 176-58.5W	57-03.0N 176-57.3W	83.4	145.5	98.9	65.4	36.5	10.8
11	July 7'	1500-1510	57-05.5N 176-56.1W	57-06.3N 176-57.3W	74.1	50.0	110.6	94.7	21.3	13.0
11	July 8	0207-0217	57-03.9N 177-01.1W	57-03.9N 177-00.7W	82.5	60.7	80.9	19.4	9.4	5.8
12	July 9	0927-0937	57-01.9N 172-27.3W	57-01.7N 172-27.5W	43.4	22.5	23.3	22.5	32.7	4.5
13	July 10	0128-0138	56-59.0N 168-00.0W	56-58.5N 167-59.6W	3.4	2.5	5.6	9.6	6.0	No sample
15	July 10	2240-2250	56-59.8N 162-55.8W	56-59.6N 162-52.7W	27.5	40.5	32.7	26.6 (20 m)	61.0 (30 m)	
17	July 11	1927-1937	59-33.9N 167-00.3W	59-34.5N 167-00.3W	3.2	3.7	5.2	6.1 (15 m)		
20	July 13	1937-1947	55-01.8N 168-09.5W	55-02.2N 168-08.5W	3.0	8.6	1.9	10.1	3.8	9.5
26	July 18	2132-2142	49-57.3N 155-03.9W	49-56.7N 155-04.8W	13.8	No sample	17.1	19.6	10.8	6.9
30	Aug. 3	0021-0031	49-57.3N 144-28.0W	49-57.4N 144-28.2W	21.1	19.4	13.3	9.2	13.7	No sample
30	Aug. 3	0535-0545	49-57.5N 144-29.1W	49-57.4N 144-29.7W	5.2	8.1	11.0	32.4	6.3	17.1
30	Aug. 3	1221-1231	49-57.0N 144-32.0W	49-57.0N 144-33.0W	1.2	1.8	2.0	37.9	6.6	14.5

MTD net: mouth dia.; 56 cm, mouth area; 2,462 cm^2, towing speed; 1.5-2 knots.

Current measurement

K. Takano

Short period current measurements using EG & G model 102 current meters were done by three moorings with pellet collectors as shown in Fig.14 . The first one was installed at 56°59.1'N, 167°00.8'E by Sta. 7 for two days, the second at 56°58.8'N, 165°36.5'W by Sta. 13 for a little more than two days, and the last at 50°00.8'N, 144°29.8'W by Sta. 27 for two weeks.

All were recovered. At the second site, however, current meter mooring components such as current meters, ropes, subsurface buoys, lead, acoustic release were so severely entangled that two current meters were lying down on the floor and the surfacing of the system after the release was prevented, although the pellet collector mooring line was properly set and properly recovered. The measurements at the other two sites were successful. The subsurface buoy was buoyant enough to keep the heavy mooring line almost vertical.

All the records are being analyzed.

Gravity measurement at sea

H. Fujimoto

Track of the ship : Fig. 1, Observed period : June 21-Aug. 18, 1975

Gravity meter system : T. S. S. G.; Gravity meter : Model Z-68-7-14 (string type); Vertical Gyro : Model 72-A (0.05 sec. sampling rate)

Gravity meter calibration points : Harumi, Tokyo ; Dutch Harbor, Alaska ; Vancouver, B. C.; Harumi, Tokyo

Trouble with gravity meter : None

Position fixing : Dead reckoned navigation, NNSS

Out of order time of NNSS : None

Out of order time of PDR : None