

dioxide was detected quantitatively by the NDIR, too. The accuracy given by the manufacturer is <2% of the determined values. Further information about analytical procedure is given elsewhere in the manual supplied by the manufacturer (OI Analytical Co.).

4. Mooring experiment

Mooring experiments were carried out in central Ongul Strait at St. K. The first mooring experiment was started on 14 May and ended on 28 July, and the second experiment was started on 31 August and ended on 26 November 1999. The mooring array design is drawn in Fig. 3. An automatic water sampler (Clean-Water Sampler NWS-11C5, Nichiyu-Giken Co.) with a water temperature recorder (NWT-SN, Nichiyu-Giken Co.) was suspended at depth 10 m and a time-serial sediment trap (SMC-500, Nichiyu-Giken Co.) with a temperature recorder (NWT-SN, Nichiyu-Giken Co.) was installed at 230 m depth. Two Acoustic Doppler Current meters with conductivity, temperature and turbidity sensors (RCM-9, AANDERRA Co.) were fixed at 15 m and 240 m depths. Seasonal temperature data from the two NWT-SN recorders (logged at 10-min interval) are drawn in Fig. 4, and that from the two current meters (logged at 30-min interval) were drawn in Figs. 5 and 6. Figures 5 and 6 describe the seasonal changes of current direction and current speed, respectively. Monthly changes of the direction and speed are also drawn in Fig. 7. Daily averaged temperatures and current velocities from 2 depths are listed in Tables 5 and 6, respectively. An aliquot of water samples obtained from the automatic sampler was used for the determination of TIC/TOC concentrations applying the same determination method as mentioned in the previous section. The results are shown in Table 7 and Fig. 8.

Acknowledgments

Support and cooperation of Drs. S. Ushio, T. Hirawake, T. Odate, K. Watanabe, G. Hashida and S. Aoki (National Institute of Polar Research) in preparing and conducting these observations are deeply appreciated. We also wish to thank Dr. H. Miyaoka, the leader of the wintering party, and all the members of JARE-40 for their help.

References

- Aoki, S and Hashida, G (2001): Oceanographic data in Lützow-Holm Bay from July 1998 to December 1998 (JARE-39) JARE Data Rep , 253 (Oceanography 22), 18 p
- Parsons, T R , Maita, Y and Lalli, G M. (1984). 4 3. Fluorometric determination of chlorophylls, and 4 4. Fluorometric determination of phaeo-pigments. A Manual of Chemical and Biological Methods for Seawater Analysis Oxford, Pergamon Press, 107-110
- Tsuchiya Y (2000) Yagai kôdô (Field activities in JARE-40). Nihon Nankyoku Chiiki Kansokutai Dai-40-ji-tai Hôkoku 1998-2000 (Report of the 40th Japanese Antarctic Research Expedition 1998-2000) Tokyo, Natl Inst. Polar Res., 316-332 (in Japanese)

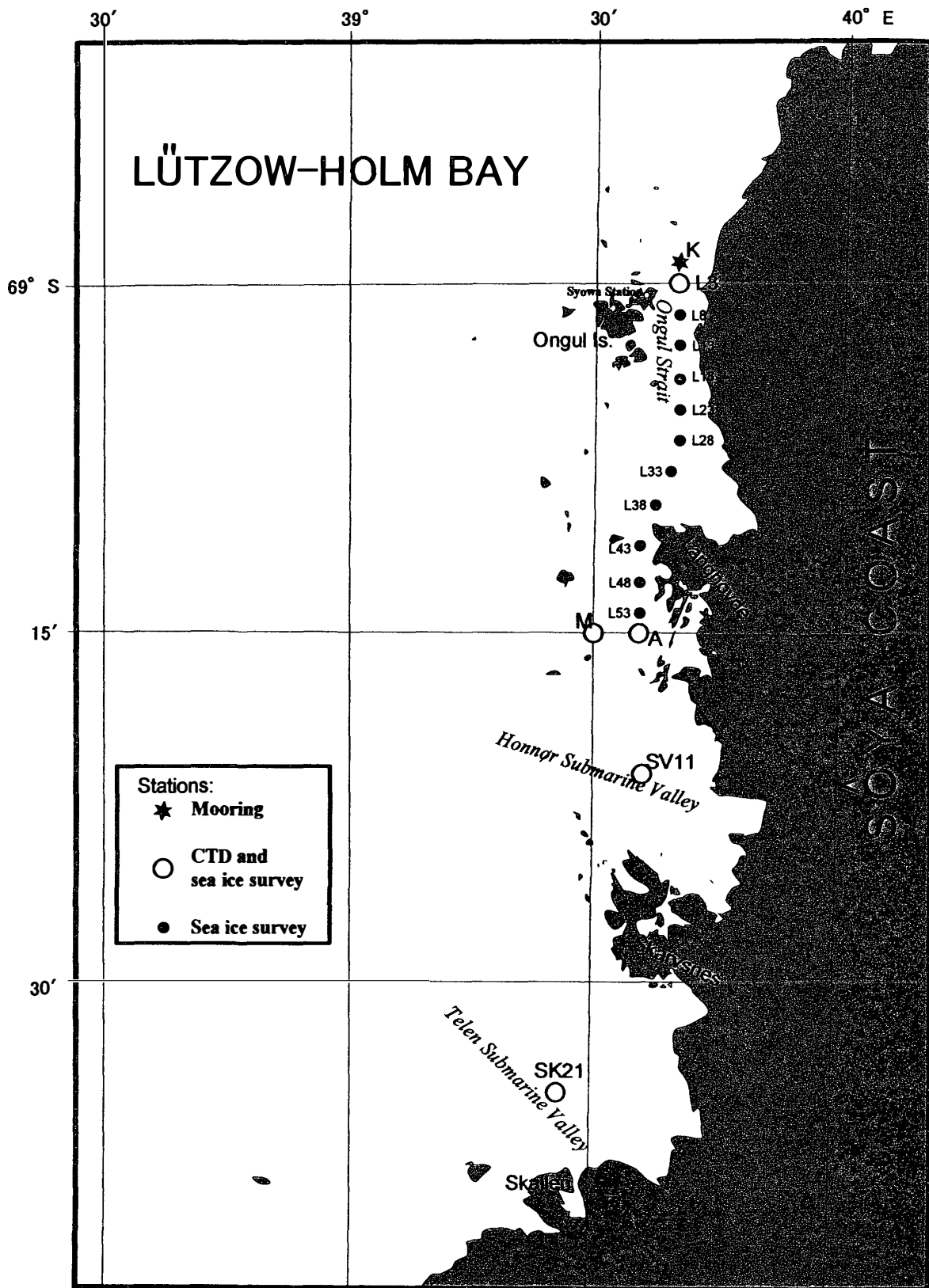


Fig. 1. Observation sites occupied by JARE-40 in 1999.

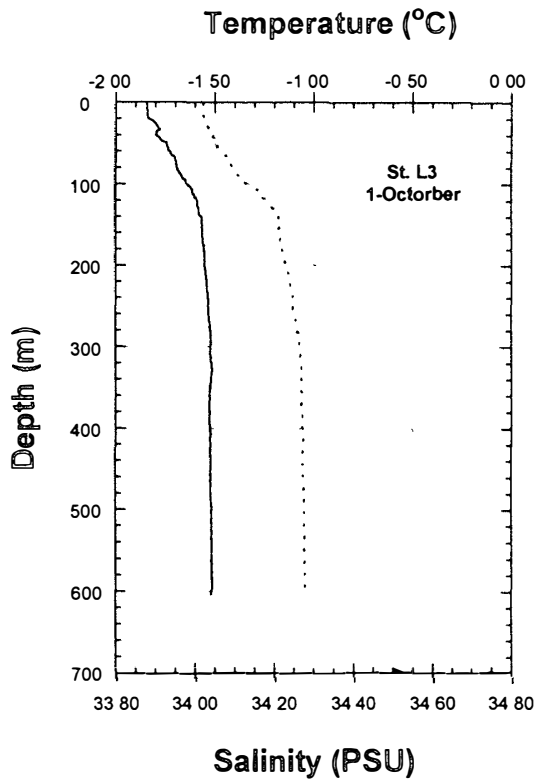


Fig. 2-1. Vertical profiles of water temperature (solid line) and salinity (dotted line) at St. L3 on 1 October 1999.

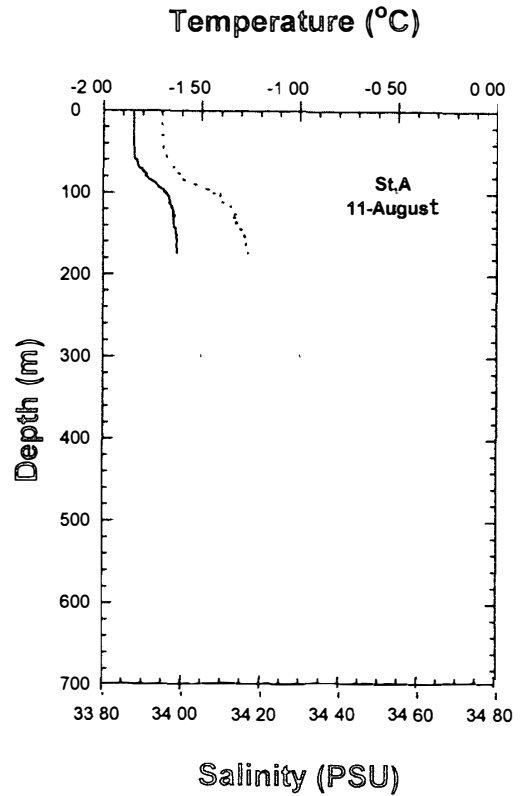


Fig. 2-2. Same as Fig. 2-1 except St. A on 11 August 1999.

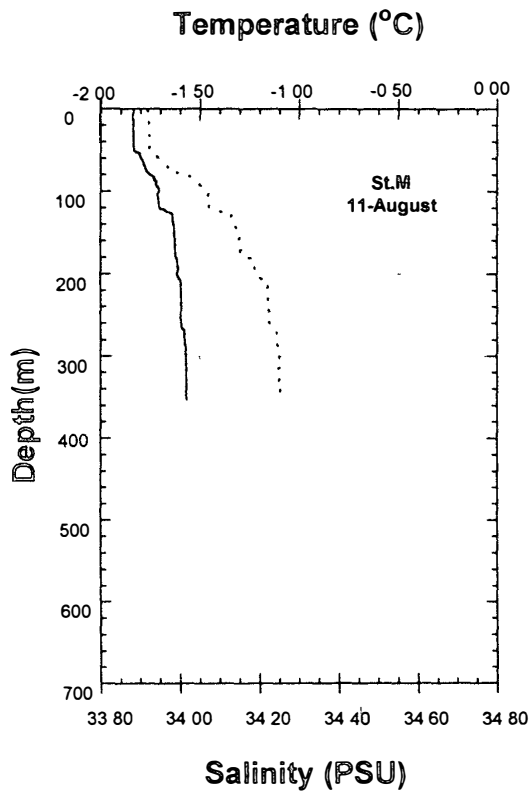


Fig. 2-3. Same as Fig. 2-1 except St. M on 11 August 1999.

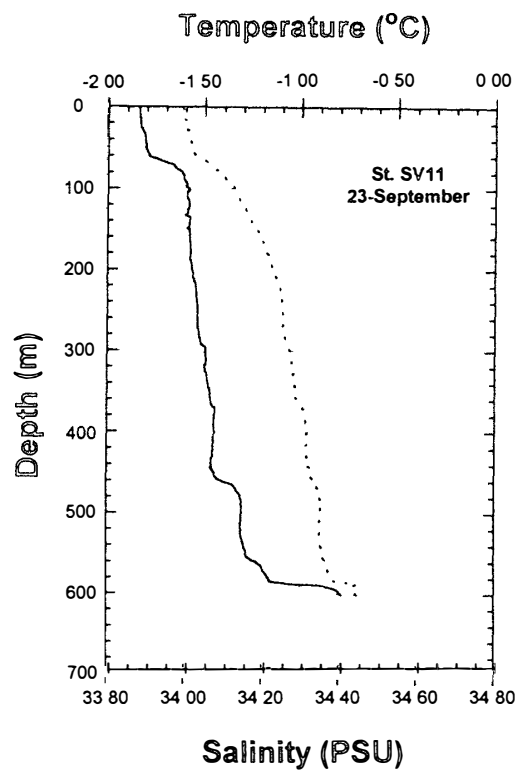


Fig. 2-4. Same as Fig. 2-1 except St. SV11 on 23 September 1999.

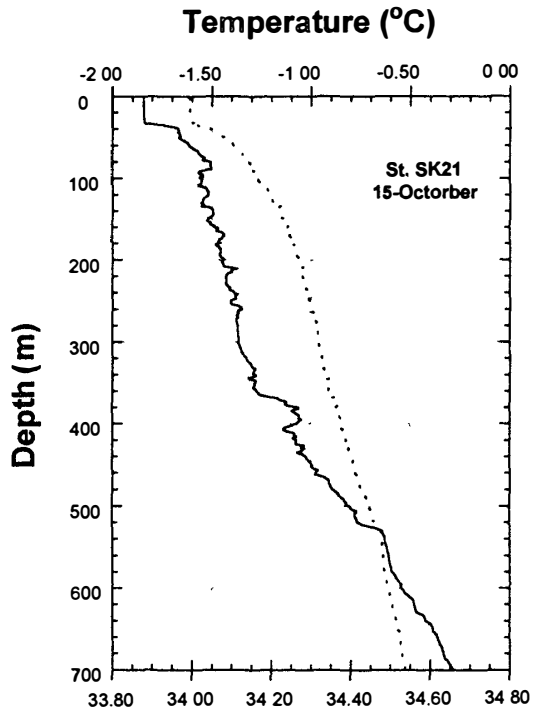


Fig. 2-5. Same as Fig. 2-1 except St. SK21 on 15 October 1999.

Salinity (PSU)

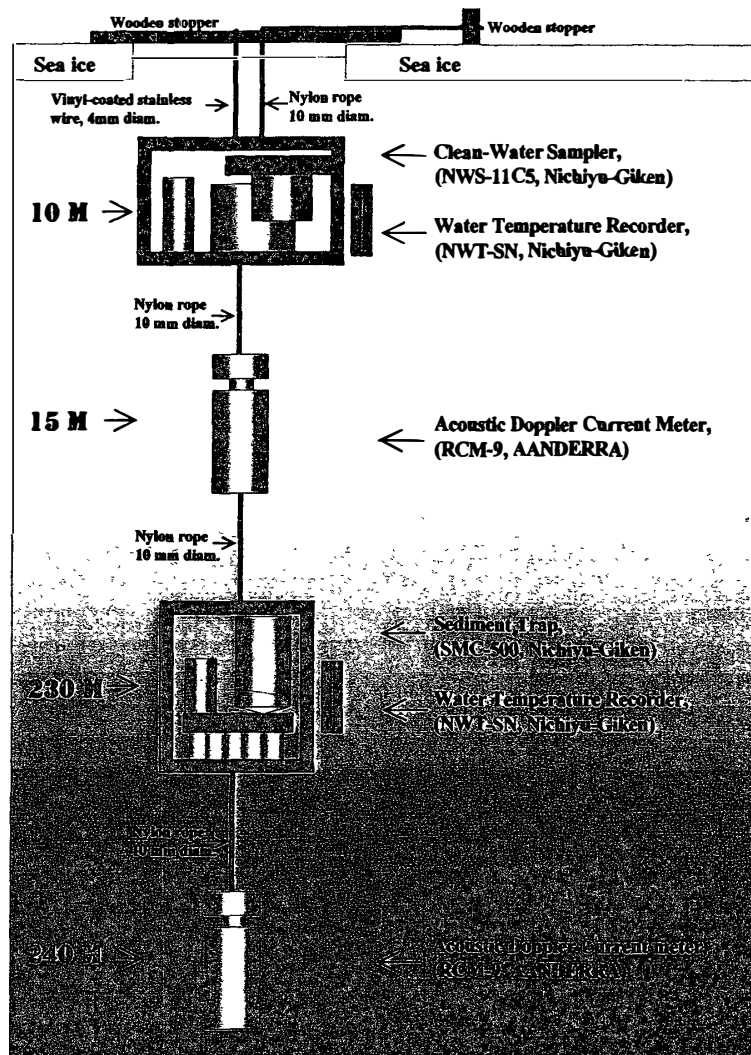


Fig. 3. A design of a mooring array at St. K.

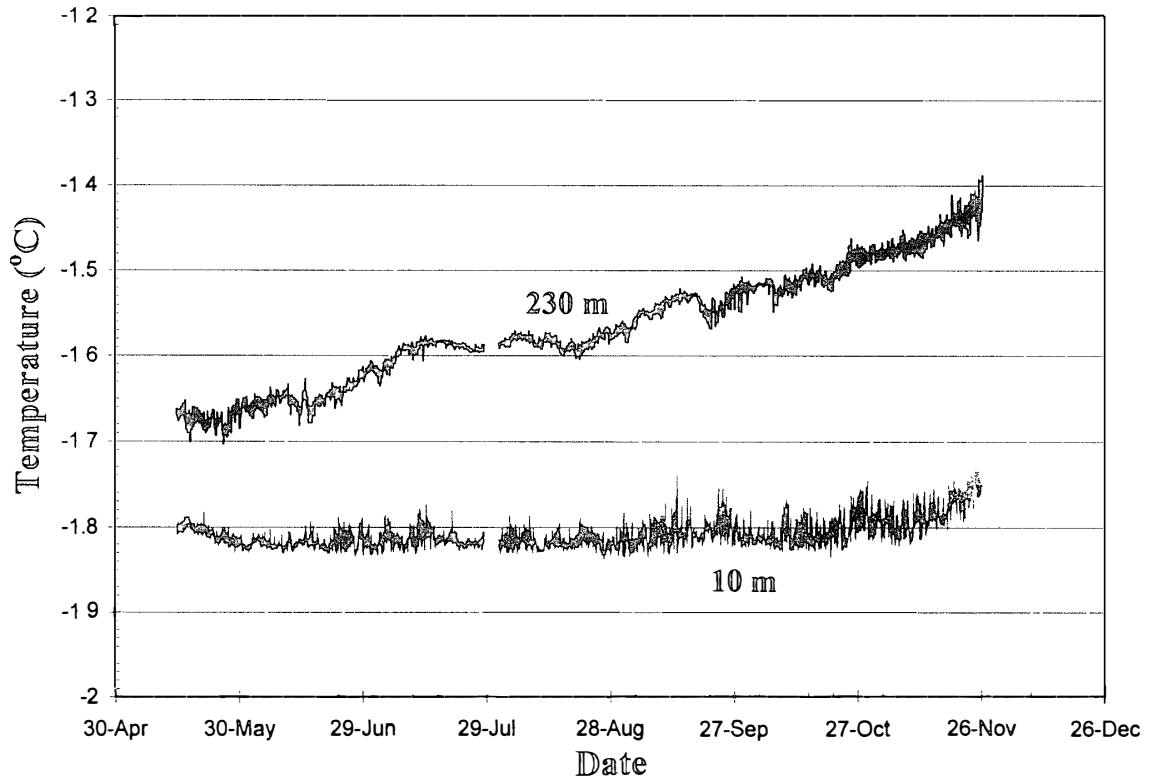


Fig. 4. Seasonal change in water temperature at St. K.

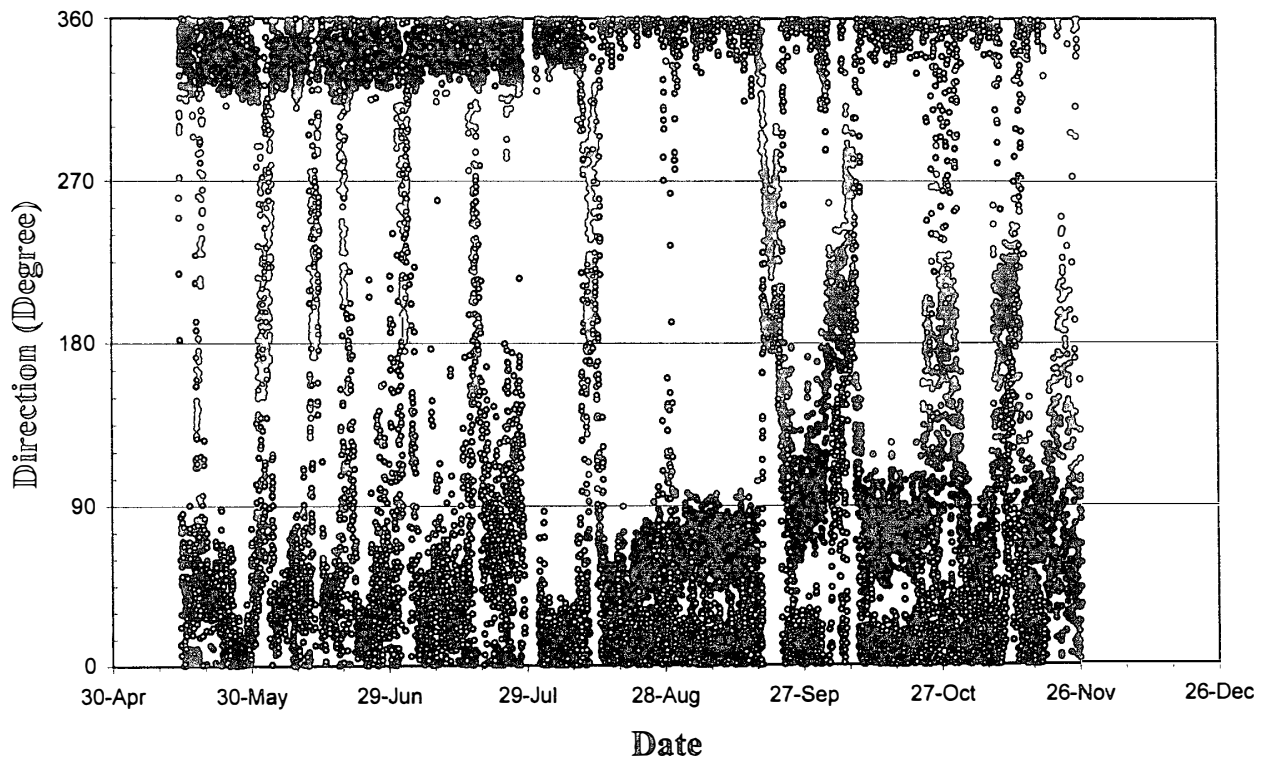


Fig. 5. Seasonal change in current direction at St. K.
Black circles indicate the data obtained at 15 m, gray ones data at 240 m.

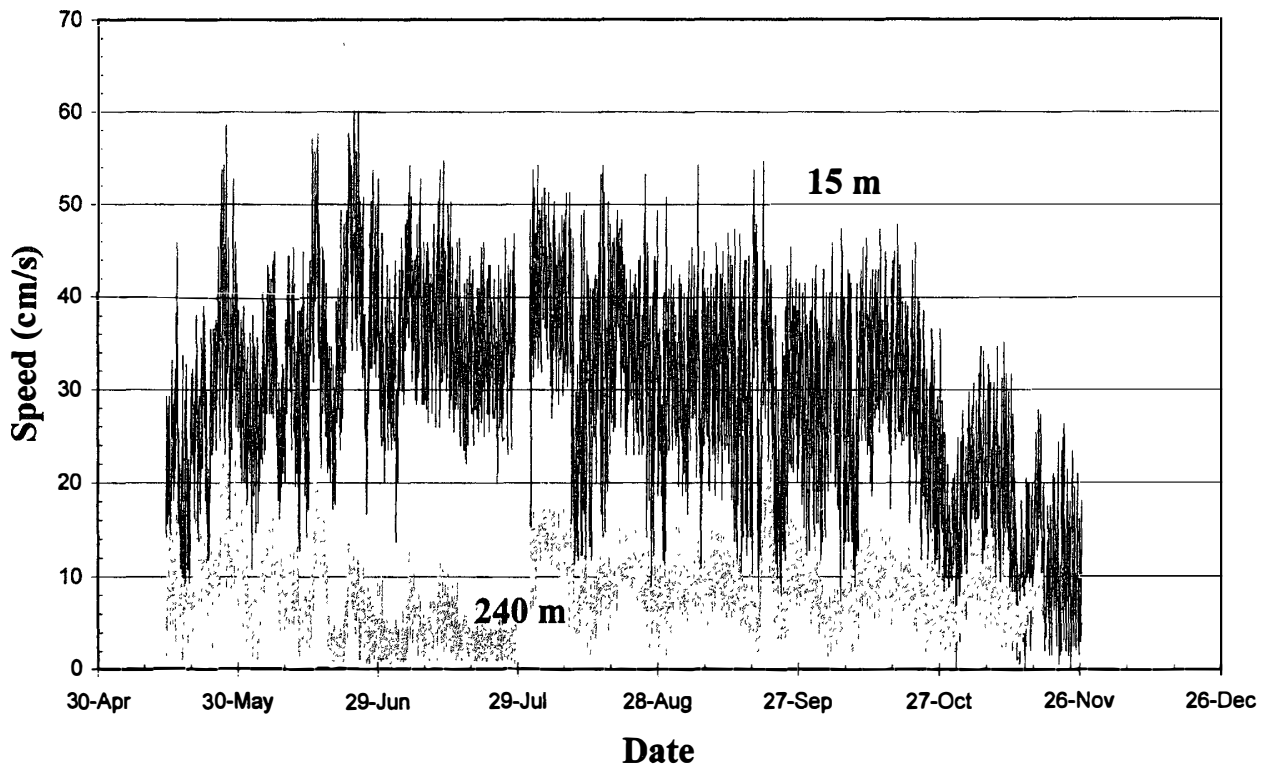


Fig. 6. Seasonal change in current speed at St. K.
 Black and gray lines indicate data obtained at 15 m and 240 m, respectively.

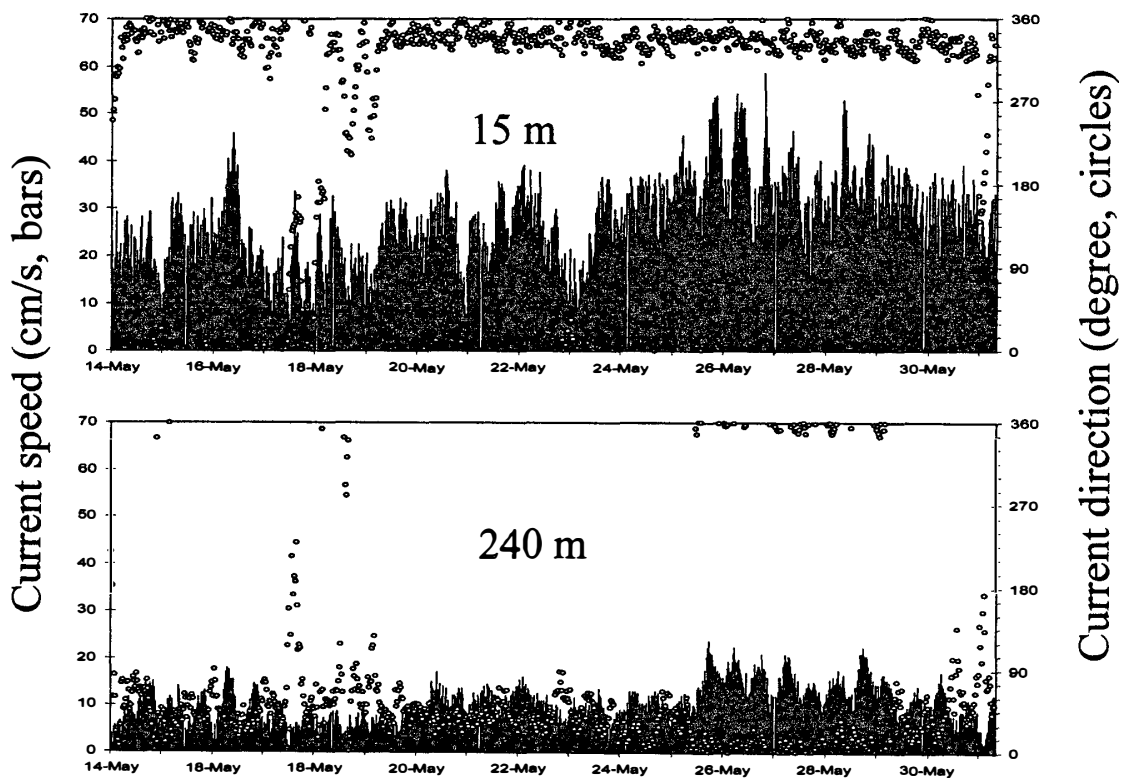


Fig. 7. Current speed and direction obtained from 2 depths at St. K in May–November 1999. Black bars indicate current speed; open circles indicate current direction.

Fig. 7-1. St. K in May 1999.

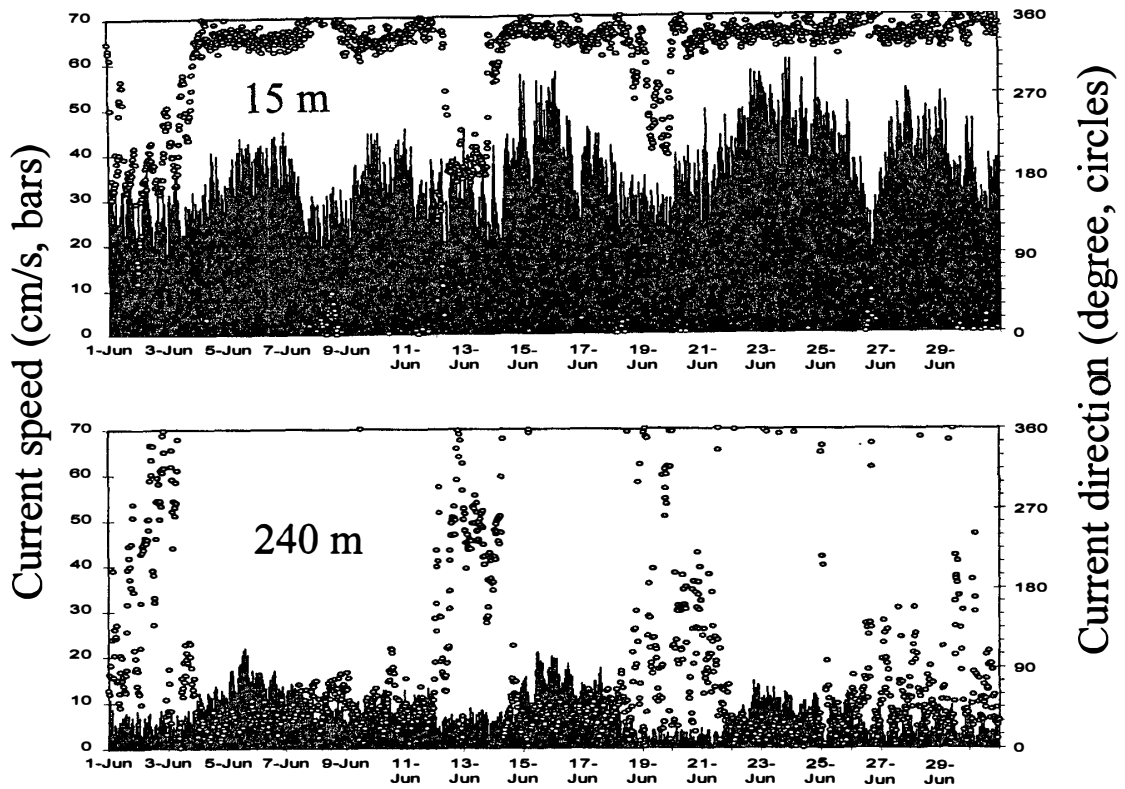


Fig. 7-2. St. K in June 1999.

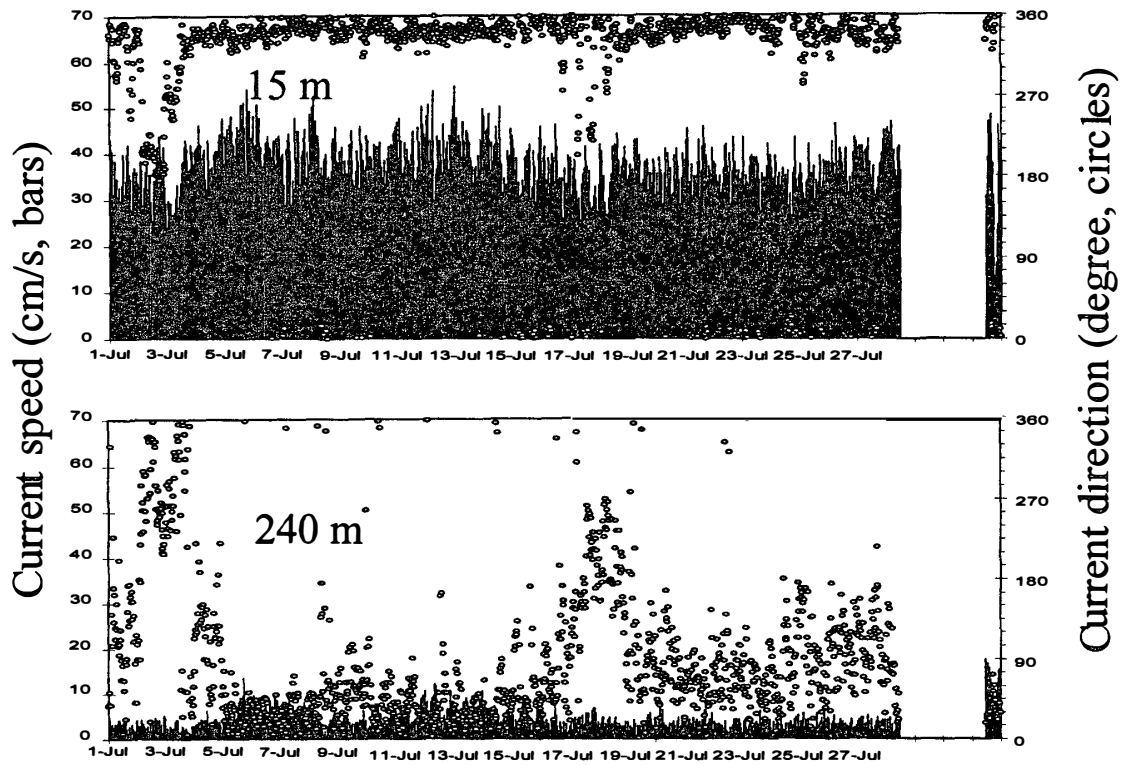


Fig. 7-3. St. K in July 1999.

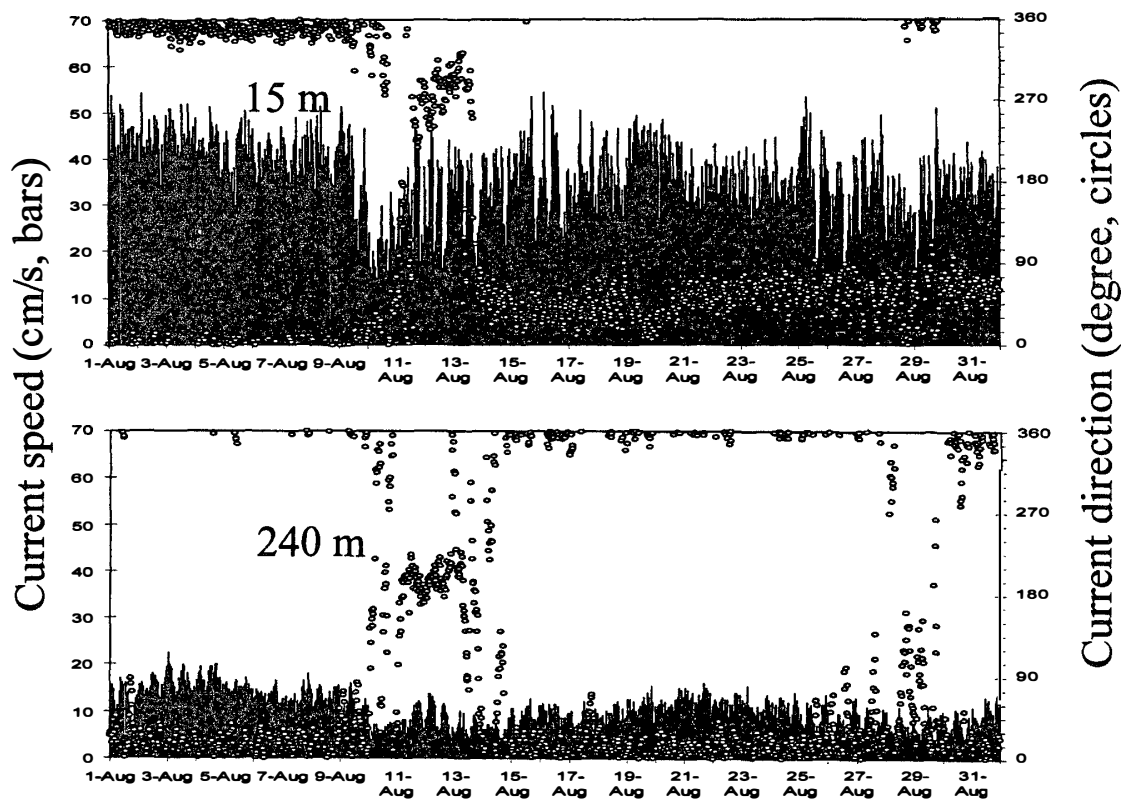


Fig. 7-4. St. K in August 1999.

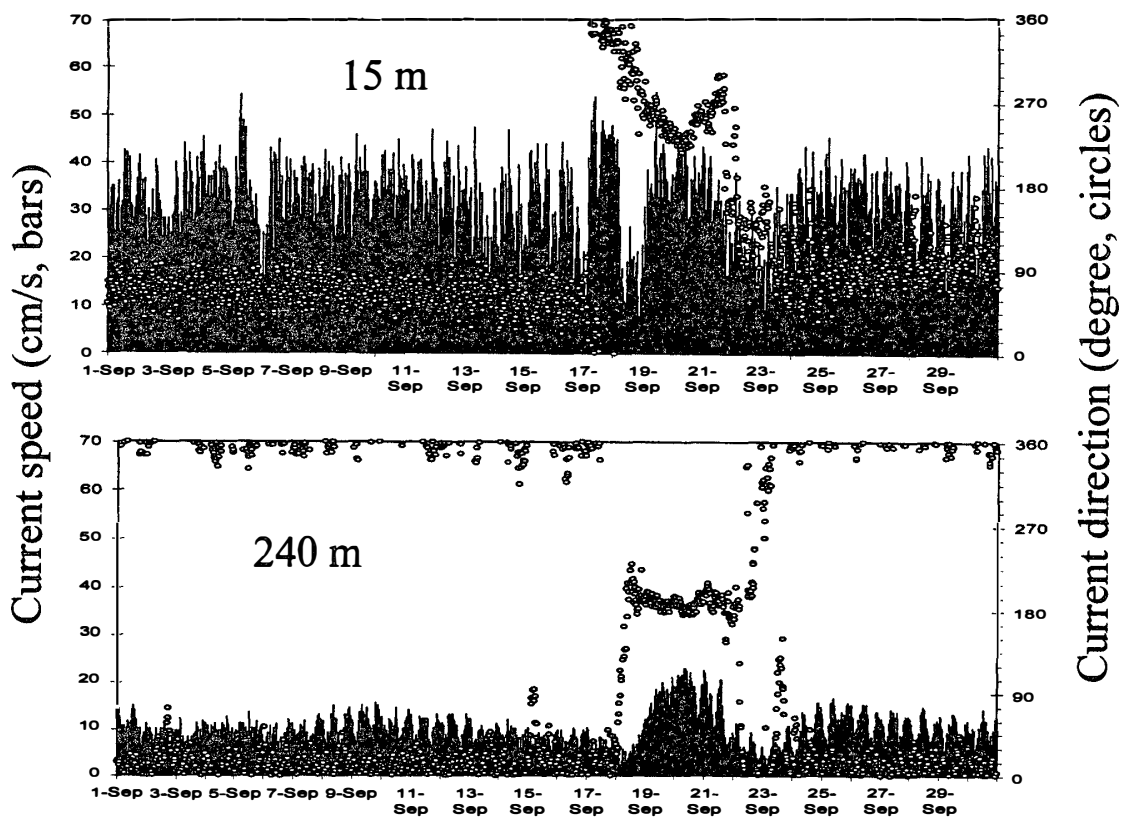


Fig. 7-5. St. K in September 1999.

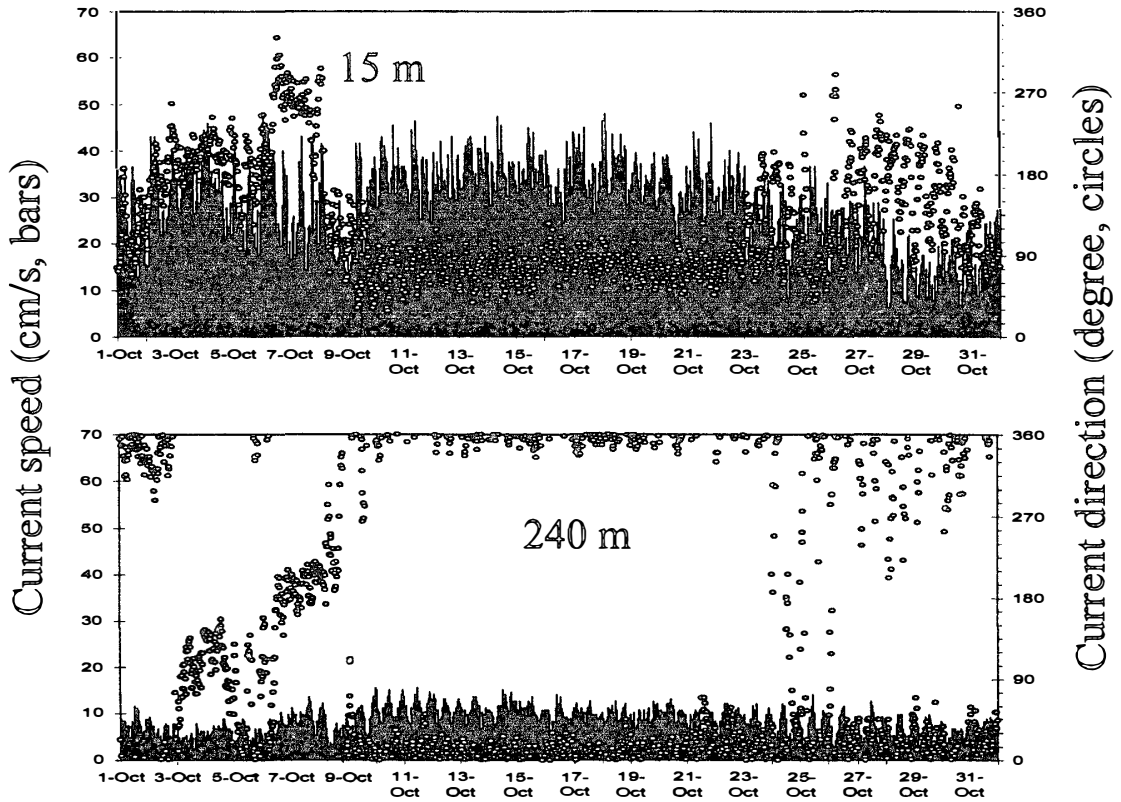


Fig. 7-6. St. K in October 1999.

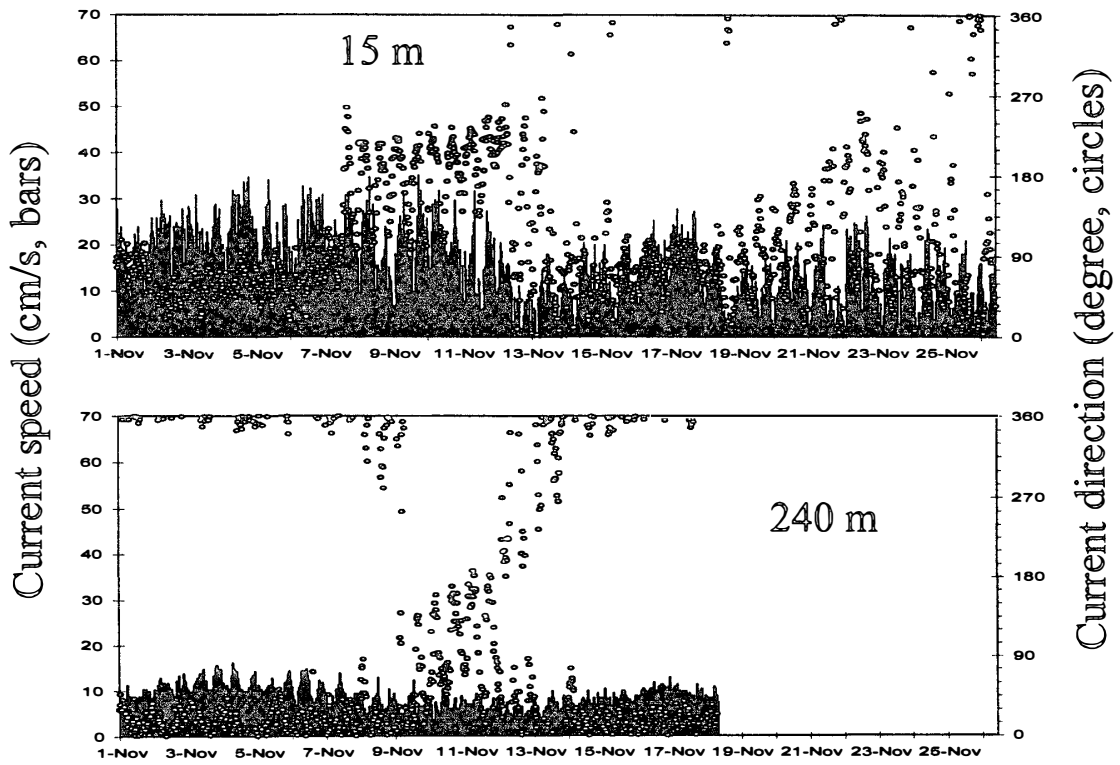


Fig. 7-7. St. K in November 1999.

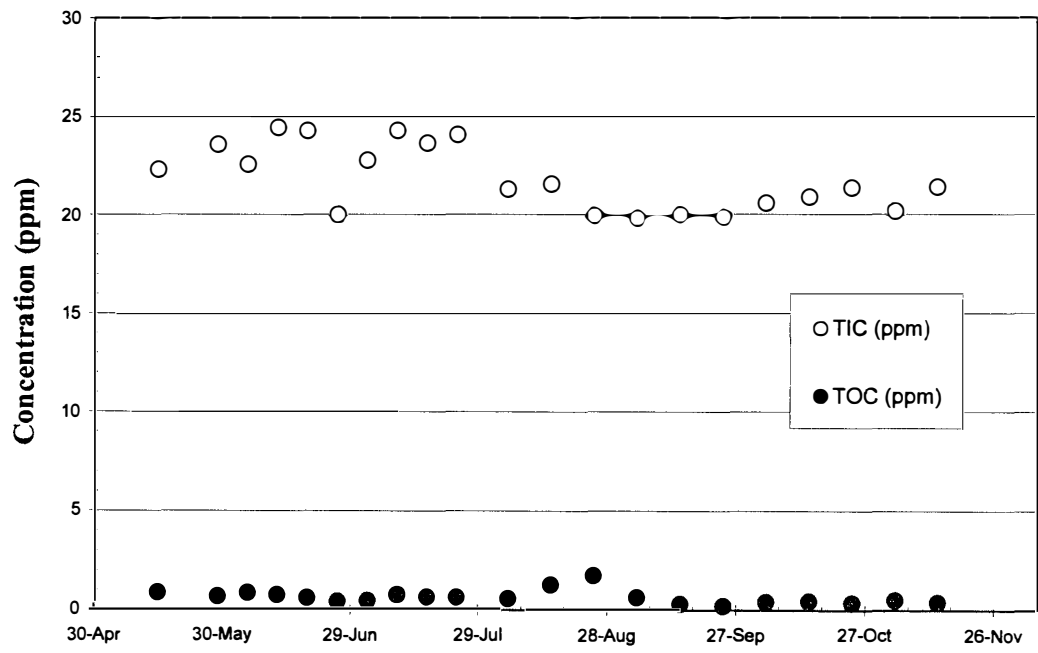


Fig. 8. Seasonal change in TIC/TOC concentrations at 10 m water depth at St. K.

Table 1. Locations of stations where oceanographic observation and sampling were carried out. *nd* in the depth column indicates no data.

Stations	Latitude, S (Deg. Min. Sec.)	Longitude, E (Deg. Min. Sec.)	Depth (m)	Observations
K	68 59 45	39 40 00	615	Mooring, ice survey
L3	69 00 14	39 40 17	623	CTD, ice survey
L8	69 01 37	39 40 15	<i>nd</i>	ice survey
L13	69 02 59	39 40 13	<i>nd</i>	ice survey
L18	69 04 24	39 40 12	<i>nd</i>	ice survey
L23	69 05 45	39 40 09	<i>nd</i>	ice survey
L28	69 07 07	39 39 53	<i>nd</i>	ice survey
L33	69 08 29	39 38 16	<i>nd</i>	ice survey
L38	69 09 51	39 36 42	<i>nd</i>	ice survey
L43	69 11 12	39 36 04	<i>nd</i>	ice survey
L48	69 12 45	39 35 53	<i>nd</i>	ice survey
L53	69 14 08	39 35 46	<i>nd</i>	ice survey
A	69 14 56	39 35 43	183	CTD, ice survey
M	69 15 00	39 30 00	373	CTD, ice survey
SV11	69 21 00	39 35 35	678	CTD, ice survey
SK21	69 34 57	39 25 57	977	CTD, ice survey

Table 2. Ice thickness, snow depth and chlorophyll *a* and phaeo-pigments in sea ice at the ice survey stations. *nd* indicates no data.

Stations	Date (DD-MM)	Ice thickness (cm)	Snow depth (cm)	Chlorophyll <i>a</i> (mg/m ²)	Phaeo-pigments (mg/m ²)
K	14-May	70	6	<i>nd</i>	<i>nd</i>
K	28-Jun.	135	60	<i>nd</i>	<i>nd</i>
K	25-Nov.	110	55	10.53	1.68
L3	21-Oct.	140	40	6.55	3.05
L8	21-Oct.	153	17	11.26	1.40
L13	21-Oct.	150	2	21.82	1.36
L18	21-Oct.	142	12	4.62	1.61
L23	21-Oct.	152	14	9.85	2.21
L28	21-Oct.	165	0	27.57	3.06
L33	21-Oct.	165	0	7.73	0.38
L38	21-Oct.	112	38	2.58	1.41
L43	21-Oct.	157	0	1.93	0.23
L48	21-Oct.	152	0	8.97	0.99
L53	21-Oct.	163	3	12.67	3.45
A	11-Aug.	135	0	3.29	3.24
A	16-Oct.	140	0	4.44	0.34
A	23-Nov.	150	0	<i>nd</i>	<i>nd</i>
M	11-Aug.	155	3	4.37	3.89
SV11	23-Sep.	160	10	4.08	3.67
SK21	15-Oct.	155	17	4.23	1.40

Station: L3 Table 3. CTD observation data.
 Date: 1-October, 1999 Time: 09 40 (LT)

Depth (m)	Temperature (oC)	Salinity (PSU)	Sigma-T
5	-1.84	34.02	27.39
10	-1.84	34.02	27.39
20	-1.83	34.02	27.39
30	-1.79	34.02	27.39
50	-1.74	34.05	27.41
75	-1.70	34.09	27.44
100	-1.64	34.13	27.47
125	-1.59	34.19	27.51
150	-1.56	34.21	27.53
200	-1.55	34.23	27.55
250	-1.53	34.25	27.56
300	-1.52	34.26	27.57
400	-1.52	34.27	27.58
500	-1.52	34.28	27.58
600	-1.51	34.28	27.59

Station: A
 Date: 11-August, 1999 Time: 10 40 (LT)

Depth (m)	Temperature (oC)	Salinity (PSU)	Sigma-T
5	-1.85	33.95	27.33
10	-1.85	33.95	27.33
20	-1.85	33.95	27.33
30	-1.85	33.95	27.33
50	-1.84	33.96	27.33
75	-1.79	33.99	27.36
100	-1.68	34.07	27.42
125	-1.64	34.14	27.48
150	-1.63	34.16	27.49
174	-1.62	34.17	27.50

Station: M
 Date: 11-August, 1999 Time: 14:40 (LT)

Depth (m)	Temperature (oC)	Salinity (PSU)	Sigma-T
5	-1.84	33.92	27.30
10	-1.84	33.92	27.30
20	-1.83	33.92	27.30
30	-1.84	33.92	27.30
50	-1.83	33.92	27.30
75	-1.77	33.98	27.35
100	-1.71	34.07	27.42
125	-1.66	34.10	27.45
150	-1.63	34.14	27.48
200	-1.61	34.19	27.52
250	-1.60	34.22	27.54
300	-1.57	34.25	27.56
350	-1.57	34.25	27.56

Table 3. Continued.

Station: SV11

Date: 23-September, 1999

Time: 12:40 (LT)

Depth (m)	Temperature (°C)	Salinity (PSU)	Sigma-T
5	-1.84	33.99	27.36
10	-1.84	34.00	27.37
20	-1.84	34.00	27.37
30	-1.82	34.01	27.38
50	-1.81	34.02	27.38
75	-1.64	34.08	27.43
100	-1.58	34.13	27.47
125	-1.58	34.16	27.49
150	-1.58	34.18	27.51
200	-1.56	34.23	27.55
250	-1.53	34.25	27.56
300	-1.49	34.27	27.58
400	-1.45	34.31	27.61
500	-1.30	34.35	27.64
600	-0.79	34.44	27.69

Station: SK21

Date: 15-October, 1999

Time: 12:30 (LT)

Depth (m)	Temperature (°C)	Salinity (PSU)	Sigma-T
5	-1.84	34.00	27.37
10	-1.84	34.00	27.37
20	-1.84	34.00	27.37
30	-1.84	34.00	27.37
50	-1.66	34.08	27.43
75	-1.53	34.13	27.47
100	-1.55	34.17	27.50
125	-1.55	34.20	27.52
150	-1.52	34.23	27.55
200	-1.44	34.27	27.57
250	-1.41	34.30	27.60
300	-1.36	34.32	27.62
400	-1.07	34.37	27.65
500	-0.80	34.45	27.70
600	-0.54	34.49	27.72
700	-0.28	34.54	27.75

Table 4. Total inorganic carbon (TIC, ppm) and total organic carbon (TOC, ppm) concentrations in water at several stations. *nd* indicates no data.

Depth (m)	Stations (Date)		A (11-Aug)		A (16-Oct)	
	L3 TIC	(1-Oct) TOC	TIC	TOC	TIC	TOC
1	24.06	0.52	24.14	0.80	25.40	0.44
10	<i>nd</i>	<i>nd</i>	24.53	0.66	<i>nd</i>	<i>nd</i>
25	25.17	0.23	24.71	0.60	25.48	0.48
50	25.35	0.40	24.56	0.44	25.26	0.59
100	26.63	0.34	24.86	0.37	25.73	0.56
150	<i>nd</i>	<i>nd</i>	25.01	0.34	25.49	0.64
200	26.96	0.47				
300	26.53	0.25				
600	25.75	0.40				

Depth (m)	Stations (Date)		SV11 (23-Sep)		SK21 (15-Oct)	
	M TIC	(11-Aug) TOC	TIC	TOC	TIC	TOC
1	24.68	0.33	24.22	0.39	24.64	0.09
10	24.94	0.32	<i>nd</i>	<i>nd</i>	<i>nd</i>	<i>nd</i>
25	24.94	0.40	24.88	0.33	24.77	0.00
50	25.04	0.23	24.95	1.17	24.50	0.42
100	24.89	0.25	25.16	0.41	24.48	0.48
150	<i>nd</i>	<i>nd</i>	<i>nd</i>	<i>nd</i>	<i>nd</i>	<i>nd</i>
200	25.15	0.45	25.38	0.26	24.92	0.37
300	24.88	0.51	26.73	0.35	24.63	0.41
600			26.85	0.31	25.09	0.44

Table 5-1. Daily average, maximum and minimum water temperature at depths of 10 and 230 m.

Date	Temperature (°C) at 10 m depth			Temperature (°C) at 230 m depth		
	Average	Maximum	Minimum	Average	Maximum	Minimum
15-May	-1 803	-1.795	-1 809	-1 668	-1 662	-1 676
16-May	-1 799	-1 788	-1 807	-1.664	-1 656	-1 675
17-May	-1 794	-1 788	-1 803	-1.676	-1 652	-1 690
18-May	-1.798	-1 788	-1 805	-1.676	-1.660	-1 700
19-May	-1 803	-1.796	-1 808	-1 668	-1 660	-1 683
20-May	-1 802	-1 795	-1.810	-1.671	-1 661	-1.679
21-May	-1 804	-1 783	-1.810	-1 677	-1 666	-1 687
22-May	-1 807	-1 798	-1 813	-1 680	-1 665	-1 690
23-May	-1 807	-1 801	-1.814	-1.672	-1 663	-1 684
24-May	-1 815	-1.805	-1.822	-1 678	-1 664	-1.693
25-May	-1.814	-1 805	-1 812	-1.675	-1 666	-1 692
26-May	-1 811	-1 800	-1.820	-1.687	-1 679	-1 703
27-May	-1 812	-1 801	-1 824	-1.681	-1 661	-1 695
28-May	-1 816	-1 807	-1 830	-1.670	-1 658	-1 690
29-May	-1.820	-1 811	-1 829	-1 664	-1.651	-1 678
30-May	-1 819	-1 809	-1.828	-1.667	-1 651	-1 685
31-May	-1 824	-1 820	-1 828	-1.657	-1.649	-1 666
Monthly	-1.809	-1 783	-1 830	-1 672	-1.649	-1 703

Table 5-2. Daily average, maximum and minimum water temperature at depths of 10 and 230 m.

Date	Temperature (°C) at 10 m depth			Temperature (°C) at 230 m depth		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Jun	-1.825	-1.820	-1.830	-1.662	-1 648	-1 670
2-Jun	-1 816	-1.807	-1 825	-1 662	-1.645	-1 673
3-Jun	-1 813	-1 808	-1 818	-1 656	-1 647	-1.664
4-Jun	-1.817	-1.808	-1 824	-1.656	-1 648	-1 667
5-Jun	-1 819	-1 806	-1.825	-1.660	-1 648	-1 672
6-Jun	-1 820	-1 803	-1 826	-1.650	-1 627	-1.660
7-Jun	-1 822	-1 811	-1.827	-1 652	-1 646	-1 659
8-Jun	-1 822	-1 816	-1 826	-1 645	-1 640	-1.657
9-Jun	-1 825	-1 809	-1 831	-1 648	-1 641	-1 656
10-Jun	-1 823	-1 815	-1.828	-1 643	-1 633	-1.649
11-Jun	-1 818	-1 805	-1 828	-1 652	-1 637	-1 669
12-Jun	-1.823	-1 816	-1 829	-1 655	-1 648	-1 659
13-Jun	-1.818	-1.813	-1.824	-1 662	-1 653	-1 681
14-Jun	-1 817	-1 809	-1 822	-1 653	-1 639	-1 669
15-Jun	-1.815	-1.798	-1.824	-1.652	-1 627	-1 678
16-Jun	-1 813	-1 793	-1 823	-1 667	-1 659	-1 678
17-Jun	-1.820	-1.798	-1 828	-1 656	-1 649	-1 670
18-Jun	-1 820	-1.812	-1 827	-1 654	-1 645	-1 659
19-Jun	-1 825	-1.814	-1 828	-1 653	-1 646	-1 659
20-Jun	-1 826	-1.819	-1 831	-1 646	-1 643	-1 652
21-Jun	-1.820	-1.804	-1 828	-1.642	-1.632	-1 652
22-Jun	-1 817	-1 800	-1 832	-1 646	-1 636	-1 661
23-Jun	-1 814	-1.788	-1.831	-1 646	-1 636	-1 658
24-Jun	-1 815	-1.794	-1.830	-1 641	-1.636	-1.653
25-Jun	-1 814	-1 795	-1 829	-1 632	-1 626	-1 641
26-Jun	-1.812	-1 799	-1 830	-1.634	-1.626	-1 641
27-Jun	-1 826	-1.805	-1.834	-1.632	-1 624	-1 636
28-Jun	-1.806	-1.789	-1.828	-1 622	-1 616	-1 631
29-Jun	-1 819	-1.807	-1 833	-1 621	-1.613	-1 630
30-Jun	-1 817	-1.797	-1.832	-1.614	-1 606	-1 621
Monthly	-1 819	-1 788	-1 834	-1 647	-1 606	-1 681

Table 5-3. Daily average, maximum and minimum water temperature at depths of 10 and 230 m.

Date	Temperature (°C) at 10 m depth			Temperature (°C) at 230 m depth		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Jul	-1.824	-1.809	-1.833	-1.612	-1.607	-1.620
2-Jul	-1.823	-1.806	-1.833	-1.619	-1.612	-1.632
3-Jul	-1.820	-1.805	-1.832	-1.623	-1.612	-1.635
4-Jul	-1.810	-1.786	-1.829	-1.611	-1.604	-1.622
5-Jul	-1.810	-1.789	-1.829	-1.611	-1.604	-1.623
6-Jul	-1.819	-1.805	-1.829	-1.606	-1.601	-1.615
7-Jul	-1.817	-1.806	-1.829	-1.596	-1.589	-1.607
8-Jul	-1.820	-1.810	-1.831	-1.593	-1.585	-1.599
9-Jul	-1.822	-1.813	-1.831	-1.590	-1.587	-1.594
10-Jul	-1.809	-1.796	-1.823	-1.592	-1.585	-1.599
11-Jul	-1.818	-1.797	-1.832	-1.594	-1.584	-1.605
12-Jul	-1.806	-1.779	-1.828	-1.588	-1.582	-1.598
13-Jul	-1.808	-1.783	-1.827	-1.585	-1.587	-1.606
14-Jul	-1.804	-1.774	-1.824	-1.583	-1.577	-1.590
15-Jul	-1.806	-1.794	-1.826	-1.583	-1.580	-1.587
16-Jul	-1.814	-1.798	-1.824	-1.585	-1.584	-1.590
17-Jul	-1.814	-1.808	-1.821	-1.583	-1.583	-1.584
18-Jul	-1.815	-1.804	-1.822	-1.583	-1.582	-1.585
19-Jul	-1.815	-1.807	-1.819	-1.586	-1.582	-1.591
20-Jul	-1.811	-1.781	-1.819	-1.585	-1.583	-1.588
21-Jul	-1.814	-1.804	-1.822	-1.588	-1.585	-1.593
22-Jul	-1.821	-1.814	-1.827	-1.588	-1.586	-1.592
23-Jul	-1.822	-1.816	-1.826	-1.588	-1.585	-1.592
24-Jul	-1.819	-1.812	-1.825	-1.591	-1.588	-1.595
25-Jul	-1.819	-1.816	-1.824	-1.594	-1.592	-1.596
26-Jul	-1.818	-1.812	-1.825	-1.593	-1.587	-1.595
27-Jul	-1.818	-1.811	-1.827	-1.592	-1.587	-1.596
28-Jul	-1.816	-1.805	-1.823	-1.593	-1.587	-1.598
Monthly	-1.815	-1.774	-1.833	-1.594	-1.577	-1.635

Table 5-4. Daily average, maximum and minimum water temperature at depths of 10 and 230 m.

Date	Temperature (°C) at 10 m depth			Temperature (°C) at 230 m depth		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Aug	-1.821	-1.801	-1.831	-1.587	-1.583	-1.591
2-Aug	-1.815	-1.807	-1.830	-1.585	-1.579	-1.590
3-Aug	-1.817	-1.787	-1.830	-1.586	-1.578	-1.590
4-Aug	-1.817	-1.797	-1.830	-1.578	-1.574	-1.584
5-Aug	-1.815	-1.797	-1.831	-1.578	-1.571	-1.582
6-Aug	-1.814	-1.800	-1.826	-1.578	-1.572	-1.582
7-Aug	-1.813	-1.796	-1.828	-1.578	-1.575	-1.583
8-Aug	-1.813	-1.787	-1.826	-1.579	-1.571	-1.585
9-Aug	-1.818	-1.800	-1.830	-1.584	-1.575	-1.590
10-Aug	-1.825	-1.815	-1.830	-1.586	-1.578	-1.590
11-Aug	-1.827	-1.825	-1.829	-1.585	-1.581	-1.592
12-Aug	-1.817	-1.808	-1.825	-1.579	-1.573	-1.584
13-Aug	-1.818	-1.804	-1.826	-1.580	-1.573	-1.590
14-Aug	-1.815	-1.804	-1.825	-1.581	-1.576	-1.586
15-Aug	-1.813	-1.795	-1.824	-1.587	-1.576	-1.596
16-Aug	-1.818	-1.807	-1.828	-1.595	-1.583	-1.600
17-Aug	-1.822	-1.816	-1.827	-1.592	-1.588	-1.595
18-Aug	-1.819	-1.802	-1.826	-1.589	-1.580	-1.595
19-Aug	-1.817	-1.808	-1.826	-1.592	-1.584	-1.603
20-Aug	-1.813	-1.789	-1.824	-1.594	-1.586	-1.604
21-Aug	-1.811	-1.796	-1.824	-1.591	-1.583	-1.598
22-Aug	-1.812	-1.798	-1.824	-1.587	-1.580	-1.593
23-Aug	-1.812	-1.798	-1.823	-1.583	-1.574	-1.592
24-Aug	-1.817	-1.805	-1.830	-1.581	-1.573	-1.590
25-Aug	-1.818	-1.804	-1.833	-1.574	-1.567	-1.585
26-Aug	-1.823	-1.805	-1.837	-1.576	-1.567	-1.581
27-Aug	-1.821	-1.813	-1.828	-1.572	-1.566	-1.586
28-Aug	-1.820	-1.809	-1.832	-1.576	-1.572	-1.581
29-Aug	-1.821	-1.798	-1.831	-1.572	-1.563	-1.579
30-Aug	-1.816	-1.801	-1.833	-1.568	-1.560	-1.574
31-Aug	-1.815	-1.783	-1.835	-1.569	-1.559	-1.584
Monthly	-1.817	-1.783	-1.837	-1.582	-1.559	-1.604

Table 5-5. Daily average, maximum and minimum water temperature at depths of 10 and 230 m.

Date	Temperature (°C) at 10 m depth			Temperature (°C) at 230 m depth		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Sep	-1.817	-1.794	-1.834	-1.574	-1.567	-1.584
2-Sep	-1.818	-1.794	-1.830	-1.563	-1.557	-1.569
3-Sep	-1.818	-1.801	-1.829	-1.558	-1.548	-1.569
4-Sep	-1.811	-1.791	-1.821	-1.549	-1.545	-1.554
5-Sep	-1.811	-1.793	-1.829	-1.548	-1.544	-1.552
6-Sep	-1.817	-1.784	-1.834	-1.552	-1.547	-1.557
7-Sep	-1.806	-1.787	-1.823	-1.548	-1.538	-1.557
8-Sep	-1.805	-1.790	-1.825	-1.544	-1.539	-1.551
9-Sep	-1.806	-1.785	-1.828	-1.544	-1.535	-1.556
10-Sep	-1.810	-1.772	-1.831	-1.536	-1.530	-1.546
11-Sep	-1.815	-1.778	-1.832	-1.537	-1.530	-1.542
12-Sep	-1.798	-1.764	-1.825	-1.531	-1.527	-1.536
13-Sep	-1.805	-1.739	-1.830	-1.531	-1.521	-1.539
14-Sep	-1.807	-1.775	-1.823	-1.530	-1.521	-1.535
15-Sep	-1.804	-1.765	-1.819	-1.530	-1.524	-1.537
16-Sep	-1.800	-1.775	-1.824	-1.531	-1.527	-1.536
17-Sep	-1.809	-1.800	-1.822	-1.528	-1.526	-1.529
18-Sep	-1.813	-1.805	-1.817	-1.535	-1.527	-1.548
19-Sep	-1.810	-1.785	-1.821	-1.543	-1.534	-1.554
20-Sep	-1.800	-1.789	-1.813	-1.551	-1.539	-1.563
21-Sep	-1.805	-1.793	-1.818	-1.550	-1.532	-1.568
22-Sep	-1.803	-1.784	-1.813	-1.548	-1.532	-1.565
23-Sep	-1.792	-1.754	-1.821	-1.547	-1.535	-1.560
24-Sep	-1.794	-1.755	-1.815	-1.546	-1.530	-1.554
25-Sep	-1.797	-1.764	-1.820	-1.534	-1.525	-1.544
26-Sep	-1.802	-1.777	-1.822	-1.530	-1.519	-1.545
27-Sep	-1.800	-1.784	-1.821	-1.523	-1.516	-1.545
28-Sep	-1.812	-1.798	-1.822	-1.523	-1.512	-1.548
29-Sep	-1.811	-1.789	-1.824	-1.520	-1.507	-1.526
30-Sep	-1.814	-1.799	-1.822	-1.522	-1.512	-1.539
Monthly	-1.807	-1.739	-1.834	-1.540	-1.507	-1.584

Table 5-6. Daily average, maximum and minimum water temperature at depths of 10 and 230 m.

Date	Temperature (°C) at 10 m depth			Temperature (°C) at 230 m depth		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Oct	-1.811	-1.780	-1.820	-1.521	-1.516	-1.526
2-Oct	-1.813	-1.799	-1.820	-1.519	-1.515	-1.523
3-Oct	-1.813	-1.798	-1.820	-1.515	-1.514	-1.516
4-Oct	-1.814	-1.799	-1.821	-1.515	-1.509	-1.518
5-Oct	-1.814	-1.791	-1.826	-1.514	-1.509	-1.527
6-Oct	-1.811	-1.792	-1.826	-1.519	-1.511	-1.548
7-Oct	-1.817	-1.811	-1.826	-1.530	-1.520	-1.540
8-Oct	-1.812	-1.785	-1.828	-1.525	-1.517	-1.530
9-Oct	-1.794	-1.767	-1.817	-1.516	-1.505	-1.527
10-Oct	-1.810	-1.773	-1.826	-1.519	-1.508	-1.528
11-Oct	-1.816	-1.802	-1.827	-1.519	-1.505	-1.531
12-Oct	-1.812	-1.790	-1.827	-1.515	-1.507	-1.528
13-Oct	-1.805	-1.777	-1.824	-1.511	-1.499	-1.523
14-Oct	-1.802	-1.781	-1.825	-1.504	-1.497	-1.510
15-Oct	-1.810	-1.777	-1.827	-1.507	-1.499	-1.516
16-Oct	-1.815	-1.788	-1.828	-1.506	-1.492	-1.518
17-Oct	-1.808	-1.782	-1.826	-1.504	-1.494	-1.513
18-Oct	-1.811	-1.788	-1.825	-1.509	-1.494	-1.519
19-Oct	-1.812	-1.792	-1.825	-1.511	-1.500	-1.522
20-Oct	-1.809	-1.788	-1.835	-1.512	-1.503	-1.524
21-Oct	-1.804	-1.787	-1.820	-1.507	-1.495	-1.523
22-Oct	-1.799	-1.773	-1.824	-1.500	-1.489	-1.511
23-Oct	-1.807	-1.776	-1.827	-1.497	-1.488	-1.506
24-Oct	-1.814	-1.799	-1.824	-1.491	-1.471	-1.506
25-Oct	-1.794	-1.763	-1.816	-1.479	-1.462	-1.502
26-Oct	-1.788	-1.766	-1.814	-1.481	-1.474	-1.493
27-Oct	-1.777	-1.755	-1.806	-1.483	-1.469	-1.496
28-Oct	-1.784	-1.757	-1.804	-1.482	-1.471	-1.493
29-Oct	-1.785	-1.746	-1.814	-1.481	-1.473	-1.488
30-Oct	-1.795	-1.761	-1.815	-1.478	-1.469	-1.492
31-Oct	-1.794	-1.771	-1.812	-1.480	-1.469	-1.490
Monthly	-1.805	-1.746	-1.835	-1.505	-1.462	-1.548

Table 5-7. Daily average, maximum and minimum water temperature at depths of 10 and 230 m.

Date	Temperature (°C) at 10 m depth			Temperature (°C) at 230 m depth		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Nov	-1.790	-1.766	-1.817	-1.480	-1.468	-1.487
2-Nov	-1.796	-1.767	-1.813	-1.481	-1.467	-1.487
3-Nov	-1.793	-1.772	-1.811	-1.477	-1.465	-1.485
4-Nov	-1.800	-1.769	-1.820	-1.476	-1.462	-1.489
5-Nov	-1.806	-1.785	-1.821	-1.477	-1.468	-1.484
6-Nov	-1.795	-1.766	-1.822	-1.471	-1.452	-1.480
7-Nov	-1.795	-1.769	-1.814	-1.471	-1.453	-1.488
8-Nov	-1.802	-1.768	-1.820	-1.471	-1.464	-1.480
9-Nov	-1.797	-1.759	-1.815	-1.469	-1.461	-1.483
10-Nov	-1.777	-1.758	-1.814	-1.466	-1.457	-1.481
11-Nov	-1.795	-1.763	-1.814	-1.469	-1.453	-1.485
12-Nov	-1.790	-1.758	-1.810	-1.466	-1.456	-1.478
13-Nov	-1.783	-1.760	-1.798	-1.460	-1.447	-1.472
14-Nov	-1.778	-1.755	-1.798	-1.459	-1.448	-1.471
15-Nov	-1.785	-1.763	-1.802	-1.454	-1.438	-1.461
16-Nov	-1.788	-1.765	-1.798	-1.455	-1.434	-1.470
17-Nov	-1.783	-1.751	-1.803	-1.447	-1.434	-1.458
18-Nov	-1.771	-1.756	-1.791	-1.442	-1.411	-1.460
19-Nov	-1.763	-1.745	-1.784	-1.438	-1.429	-1.447
20-Nov	-1.767	-1.751	-1.791	-1.432	-1.414	-1.452
21-Nov	-1.771	-1.742	-1.794	-1.439	-1.423	-1.459
22-Nov	-1.762	-1.741	-1.790	-1.435	-1.419	-1.461
23-Nov	-1.754	-1.737	-1.775	-1.431	-1.409	-1.457
24-Nov	-1.745	-1.727	-1.778	-1.424	-1.405	-1.441
25-Nov	-1.750	-1.729	-1.765	-1.433	-1.393	-1.464
26-Nov	-1.751	-1.737	-1.760	-1.406	-1.388	-1.430
Monthly	-1.780	-1.727	-1.822	-1.455	-1.388	-1.489

Table 6-1. Daily average, maximum and minimum current speeds at depths of 15 and 240 m St. K in May 1999.

Date	Current speed (cm/s) at 15 m			Current speed (cm/s) at 240 m		
	Average	Maximum	Minimum	Average	Maximum	Minimum
14-May	21.4	29.33	14.18	6.2	11.73	1.47
15-May	21.6	33.25	8.80	10.3	15.16	6.89
16-May	26.8	42.53	18.09	9.3	18.09	2.44
17-May	20.8	45.96	8.31	8.7	15.64	2.93
18-May	17.1	33.73	6.36	6.3	10.27	0.49
19-May	18.3	27.38	9.29	6.3	9.29	2.93
20-May	21.6	32.27	16.13	8.4	15.16	3.42
21-May	24.8	38.13	7.82	11.5	17.11	7.33
22-May	29.4	39.11	16.62	12	16.13	7.33
23-May	19.4	37.65	9.29	9.1	12.71	5.87
24-May	29.5	36.67	18.09	9.4	13.69	2.44
25-May	34.1	45.47	23.47	10.3	13.20	5.87
26-May	40.4	54.27	24.45	16.7	23.96	7.82
27-May	36.7	58.67	22.98	15.9	21.02	8.80
28-May	32.3	52.80	16.13	13.6	17.60	8.80
29-May	35.6	50.85	25.91	15.2	22.49	9.29
30-May	31.1	38.62	20.04	15.2	17.11	6.36
31-May	28.4	39.11	17.60	10.8	12.22	1.96
Monthly	27.2	58.67	6.36	10.8	23.96	0.49

Table 6-2. Daily average, maximum and minimum current speeds at depths of 15 and 240 m at St. K in June 1999.

Date	Current speed (cm/s) at 15 m			Current speed (cm/s) at 240 m		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Jun	26.6	36.18	18.09	5.3	10.76	2.44
2-Jun.	25.9	38.13	10.76	4.8	8.31	1.47
3-Jun.	26.1	35.69	15.64	5.6	10.76	0.00
4-Jun.	29.6	40.58	22.00	10.4	13.69	7.33
5-Jun	35.8	43.51	27.38	16.0	22.00	9.78
6-Jun.	37.1	44.98	26.89	13.4	17.11	9.29
7-Jun.	27.9	39.11	16.13	9.8	14.18	4.40
8-Jun.	25.2	32.76	17.11	7.5	12.22	3.91
9-Jun.	33.1	44.49	20.04	7.6	11.73	4.89
10-Jun	35.7	45.47	23.47	8.7	12.71	4.40
11-Jun	31.1	41.56	19.56	8.7	13.20	4.40
12-Jun.	29.7	39.11	12.71	4.9	7.33	1.47
13-Jun.	28.8	44.98	14.18	5.8	8.80	2.93
14-Jun.	36.0	57.20	17.11	7.7	15.16	2.44
15-Jun.	44.1	56.22	30.80	14.6	21.02	6.36
16-Jun	38.8	57.69	21.51	14.0	16.56	9.78
17-Jun.	36.5	45.47	24.93	11.6	17.60	6.36
18-Jun.	28.7	37.65	20.04	4.6	11.24	0.00
19-Jun.	26.2	34.71	17.11	2.0	4.89	0.00
20-Jun.	32.5	41.07	23.47	2.2	4.40	0.49
21-Jun.	35.8	49.38	25.42	2.5	5.38	0.49
22-Jun.	46.3	57.69	31.78	8.3	14.67	3.42
23-Jun.	48.3	60.13	34.22	9.9	13.20	5.87
24-Jun	45.2	60.13	34.22	7.8	11.73	3.42
25-Jun.	41.7	50.85	31.29	6.8	12.22	0.00
26-Jun	28.3	38.13	16.62	4.0	8.80	0.49
27-Jun.	40.3	53.78	27.38	4.1	8.31	0.49
28-Jun.	41.2	50.85	31.29	4.5	9.29	0.98
29-Jun.	36.7	52.80	23.96	4.0	10.27	0.49
30-Jun.	31.6	46.93	20.04	3.6	6.84	0.49
Monthly	34.4	60.13	10.76	7.4	22.00	0.00

Table 6-3. Daily average, maximum and minimum current speeds at depths of 15 and 240 m at St. K in July 1999.

Date	Current speed (cm/s) at 15 m			Current speed (cm/s) at 240 m		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Jul.	33.0	43.51	23.47	2.5	4.89	0.00
2-Jul.	32.2	44.00	13.69	3.0	5.38	1.47
3-Jul.	32.7	43.02	19.07	2.1	4.40	0.49
4-Jul.	38.1	47.91	28.36	2.9	6.36	0.49
5-Jul.	43.1	54.27	35.69	6.3	13.69	1.96
6-Jul.	39.9	50.85	30.80	7.0	10.27	2.93
7-Jul.	37.4	48.89	28.36	5.9	8.31	1.47
8-Jul.	38.8	52.80	28.36	3.4	7.33	0.49
9-Jul.	36.4	45.96	26.40	3.0	6.36	0.00
10-Jul.	38.3	46.93	27.38	4.5	7.82	0.98
11-Jul.	39.3	50.36	25.91	5.6	10.76	0.98
12-Jul.	39.5	53.78	25.91	6.4	12.22	0.49
13-Jul.	39.3	54.76	29.82	6.0	10.76	1.96
14-Jul.	38.6	50.36	26.89	5.0	9.78	0.00
15-Jul.	34.4	44.00	25.42	4.7	9.29	0.98
16-Jul.	34.4	46.45	23.96	3.3	7.33	0.49
17-Jul.	31.1	41.56	22.00	3.7	6.84	0.98
18-Jul.	35.2	44.49	23.96	2.7	4.89	0.49
19-Jul.	34.4	43.02	23.96	2.5	5.87	0.00
20-Jul.	33.7	41.07	25.42	2.8	6.84	0.00
21-Jul.	35.0	45.96	24.93	3.2	6.36	0.49
22-Jul.	34.0	43.51	25.42	2.3	4.40	0.00
23-Jul.	35.0	43.51	26.89	2.9	6.36	0.49
24-Jul.	32.2	43.51	20.04	2.6	5.38	0.00
25-Jul.	33.1	42.05	24.45	3.0	6.84	0.00
26-Jul.	35.7	46.45	22.98	2.6	5.38	0.98
27-Jul.	35.8	44.98	23.47	3.2	5.38	0.98
28-Jul.	39.4	46.93	31.29	2.9	4.89	0.49
31-Jul.	33.1	48.40	7.82	12.3	17.60	6.36
Monthly	36.0	54.76	7.82	4.1	17.60	0.00

Table 6-4. Daily average, maximum and minimum current speeds at depths of 15 and 240 m at St. K in August 1999.

Date	Current speed (cm/s) at 15 m			Current speed (cm/s) at 240 m		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Aug	41.9	53.78	31.29	12.3	17.11	6.84
2-Aug	41.7	54.27	31.78	15.2	22.49	11.73
3-Aug	44.0	51.82	36.67	15.8	20.04	12.22
4-Aug	40.6	51.33	30.31	16.3	20.04	11.73
5-Aug	39.3	50.36	26.89	14.2	17.11	11.24
6-Aug	38.4	46.93	28.36	12.9	16.62	9.78
7-Aug	39.1	48.89	29.33	12.5	18.09	9.78
8-Aug	39.4	51.33	30.31	13.0	15.64	8.80
9-Aug	36.1	51.33	15.64	9.7	16.13	4.40
10-Aug	19.7	32.76	11.24	5.5	7.82	0.49
11-Aug	28.6	48.89	8.80	7.7	12.22	2.93
12-Aug	28.7	49.38	10.27	8.6	13.69	1.96
13-Aug	29.2	42.53	11.73	6.1	10.27	0.98
14-Aug	33.1	42.53	20.04	6.1	10.76	2.44
15-Aug	35.6	53.29	16.62	8.6	12.71	4.40
16-Aug	32.5	54.27	14.18	9.3	11.73	5.87
17-Aug	33.3	50.36	19.07	7.6	12.22	3.91
18-Aug	34.9	46.45	25.42	8.6	12.22	5.38
19-Aug	41.6	49.38	32.27	10.6	15.64	6.36
20-Aug	39.2	48.40	25.91	11.4	15.16	8.80
21-Aug	32.3	42.05	22.98	12.4	16.13	9.29
22-Aug	33.9	43.02	22.98	11.4	14.18	7.82
23-Aug	32.9	44.00	22.98	10.4	15.64	7.33
24-Aug	31.9	44.49	22.98	10.7	14.18	6.84
25-Aug	35.6	53.29	14.18	8.6	13.69	3.91
26-Aug	28.6	40.58	8.31	7.3	13.20	2.44
27-Aug	33.9	49.38	12.22	7.4	11.24	3.42
28-Aug	26.9	36.67	18.58	6.3	11.24	1.96
29-Aug	30.4	50.85	10.76	6.3	11.24	1.47
30-Aug	33.2	43.51	23.47	6.8	10.76	3.42
31-Aug	32.3	41.56	23.47	10.0	16.13	5.87
Monthly	34.5	54.27	8.31	10.0	22.49	0.49

Table 6-5. Daily average, maximum and minimum current speeds at depths of 15 and 240 m at St. K in September 1999.

Date	Current speed (cm/s) at 15 m			Current speed (cm/s) at 240 m		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Sep.	31.3	42.53	19.56	10.5	15.16	5.38
2-Sep.	29.2	41.56	18.58	8.30	11.73	5.87
3-Sep.	30.3	44.00	16.62	8.2	12.22	4.40
4-Sep.	34.6	45.47	26.89	9.4	12.71	6.84
5-Sep.	34.7	54.27	20.53	9.1	13.69	5.87
6-Sep.	27.8	44.98	9.78	8.1	12.22	4.89
7-Sep.	32.6	41.07	19.56	9.0	13.20	4.40
8-Sep.	32.3	42.53	19.07	10.1	15.16	5.87
9-Sep.	33.3	45.96	18.58	11.3	15.64	6.84
10-Sep.	33.8	44.98	18.09	10.3	14.67	6.36
11-Sep.	32.5	46.93	23.47	9.5	13.20	5.38
12-Sep.	31.2	44.49	18.09	9.8	13.20	5.38
13-Sep.	26.0	47.42	10.76	8.3	12.22	5.87
14-Sep.	28.4	46.93	9.78	8.1	12.22	4.40
15-Sep.	29.4	44.00	12.22	7.1	10.27	3.42
16-Sep.	26.5	44.49	14.18	7.5	10.27	3.91
17-Sep.	37.8	53.78	8.31	6.0	10.27	1.96
18-Sep.	21.0	45.47	4.89	5.7	12.22	1.96
19-Sep.	34.0	54.76	13.2	16.0	21.02	8.29
20-Sep.	36.0	43.02	20.04	18.9	22.98	10.27
21-Sep.	28.7	43.51	13.69	13.0	22.49	4.89
22-Sep.	19.6	38.13	9.78	6.0	11.24	2.44
23-Sep.	20.2	35.20	6.36	5.9	10.76	2.44
24-Sep.	29.2	43.51	11.73	8.9	15.64	2.93
25-Sep.	32.5	45.47	21.02	12.1	16.62	6.36
26-Sep.	31.9	42.05	20.04	11.2	15.16	5.87
27-Sep.	31.9	41.56	17.60	10.2	14.18	5.87
28-Sep.	27.2	41.56	11.24	9.4	14.67	4.40
29-Sep.	27.7	42.05	11.73	9.0	13.20	3.91
30-Sep.	28.6	43.51	14.18	8.9	14.18	3.91
Monthly	30.0	54.76	4.89	9.5	22.98	1.96

Table 6-6. Daily average, maximum and minimum current speeds at depths of 15 and 240 m at St. K in October 1999.

Date	Current speed (cm/s) at 15 m			Current speed (cm/s) at 240 m		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Oct.	25.9	37.65	11.73	7.5	11.73	3.91
2-Oct.	28.7	43.02	13.69	5.6	9.29	2.93
3-Oct.	31.0	40.58	19.07	4.6	7.82	1.47
4-Oct.	31.1	45.96	19.56	5.7	8.80	3.42
5-Oct.	24.4	40.58	7.33	4.9	8.80	1.47
6-Oct.	32.0	47.42	10.76	6.1	10.27	2.44
7-Oct.	23.8	43.02	10.27	8.9	13.69	3.91
8-Oct.	21.6	41.56	8.80	6.2	12.22	1.47
9-Oct.	25.0	41.56	10.27	8.4	15.64	2.93
10-Oct.	34.1	45.47	24.45	10.7	15.16	6.36
11-Oct.	33.1	46.45	22.98	10.7	15.64	6.84
12-Oct.	31.6	43.02	18.58	10.3	14.18	6.36
13-Oct.	35.3	43.02	16.89	10.0	13.69	5.38
14-Oct.	34.4	47.42	25.42	10.6	15.16	5.38
15-Oct.	34.2	44.98	26.40	10.1	13.69	6.36
16-Oct.	30.2	44.00	17.11	9.3	14.18	4.40
17-Oct.	33.6	44.98	23.47	9.5	12.71	5.87
18-Oct.	34.9	47.91	23.96	9.0	12.71	5.87
19-Oct.	31.5	39.60	24.45	8.9	12.71	5.87
20-Oct.	30.2	39.11	15.64	9.7	13.20	4.89
21-Oct.	31.2	45.96	21.51	7.3	10.76	2.93
22-Oct.	30.4	40.09	17.60	8.6	12.22	3.91
23-Oct.	24.3	38.62	11.24	8.0	12.22	2.93
24-Oct.	20.9	32.27	7.82	6.7	12.22	1.47
25-Oct.	24.1	36.67	12.71	7.2	14.18	1.96
26-Oct.	21.9	29.33	10.27	6.5	11.73	2.44
27-Oct.	20.5	36.67	6.84	6.4	12.71	1.47
28-Oct.	13.5	25.42	2.44	5.8	9.78	1.96
29-Oct.	12.1	20.53	1.96	5.8	9.78	1.96
30-Oct.	14.3	24.93	0.00	5.0	6.84	1.96
31-Oct.	16.8	27.38	2.93	6.5	9.29	3.91
Monthly	27.0	47.91	0.00	7.8	15.64	1.47

Table 6-7. Daily average, maximum and minimum current speeds at depths of 15 and 240 m at St. K in November 1999.

Date	Current speed (cm/s) at 15 m			Current speed (cm/s) at 240 m		
	Average	Maximum	Minimum	Average	Maximum	Minimum
1-Nov.	17.0	27.87	27.87	7.9	11.24	3.91
2-Nov.	22.3	29.82	29.82	10.4	13.69	6.84
3-Nov.	21.7	30.80	30.80	11.4	15.64	7.82
4-Nov.	24.9	34.71	34.71	10.3	16.13	5.87
5-Nov.	20.2	34.22	34.22	9.7	14.18	4.40
6-Nov.	23.2	32.76	32.76	9.5	14.67	5.38
7-Nov.	20.8	30.80	30.80	7.7	13.69	3.91
8-Nov.	18.4	34.71	34.71	6.7	12.71	3.42
9-Nov.	21.9	35.20	35.20	5.9	12.22	0.49
10-Nov.	20.2	31.78	31.78	6.2	10.27	1.96
11-Nov.	15.1	31.78	31.78	6.1	9.28	2.93
12-Nov.	8.9	20.53	20.53	4.6	8.31	1.47
13-Nov.	8.4	18.09	18.09	5.9	9.78	1.96
14-Nov.	10.0	20.53	20.53	6.6	9.78	3.91
15-Nov.	10.7	20.04	20.04	7.5	10.27	4.40
16-Nov.	15.7	25.42	25.42	9.4	12.71	6.84
17-Nov.	18.7	27.87	27.87	8.5	11.24	5.87
18-Nov.	9.3	20.04	20.04	8.1	10.76	5.87
19-Nov.	9.8	17.60	17.60			
20-Nov.	12.2	21.02	21.02			
21-Nov.	8.6	24.45	24.45			
22-Nov.	14.9	26.40	26.40			
23-Nov.	11.5	21.51	21.51			
24-Nov.	10.2	23.47	23.47			
25-Nov.	8.9	21.02	21.02			
26-Nov.	9.1	18.09	18.09			
Monthly	15.1	35.2	17.6	7.9	16.13	0.49

Table 7. Seasonal changes of TIC and TOC concentrations (ppm) at St. K.

Date of sampling	TIC (ppm)	TOC (ppm)
15-May	22.32	0.87
29-May	23.60	0.66
5-June	22.60	0.84
12-June	24.43	0.74
19-June	24.27	0.59
26-June	20.05	0.43
3-July	22.82	0.47
10-July	24.31	0.75
17-July	23.65	0.65
24-July	24.09	0.60
5-August	21.32	0.55
15-August	21.59	1.26
25-August	20.00	1.73
4-September	19.87	0.61
14-September	20.05	0.32
24-September	19.94	0.22
4-October	20.62	0.41
14-October	20.95	0.45
24-October	21.39	0.37
3-November	20.22	0.52
13-November	21.44	0.39