Temperature Conditions on the Shelf off Barkley Sound, Vancouver Island, February 28 - March 9, 1978

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TEMPERATURE CONDITIONS ON THE SHELF OFF BARKLEY SOUND, VANCOUVER ISLAND, FEBRUARY 28-MARCH 9, 1978

by

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ABSTRACT

Douglas, Mary, and W. Percy Wickett. 1978. Temperature conditions on the shelf off Barkley Sound, Vancouver Island, February 28-March 9, 1978. Fish. Mar. Serv. MS Rep. 1492: 25 p.

Above-normal bottom temperatures were found on the shelf off the west coast of Vancouver Island during groundfish cruise no. 78-3, March 1978. There had been above-normal onshore Ekman transport during January, February, and March 1978.

Key words: Shelf water, water temperature, Ekman transport.

RÉSUMÉ

Douglas, M., and W. P. Wickett. 1978. Temperature conditions on the shelf off Barkley Sound, Vancouver Island, February 28-March 9, 1978. Fish. Mar. Serv. MS Rep. 1492: 25 p.

Les auteurs ont trouvé des températures de l'eau du haut-fond au-dessus de la normale au large de la côte ouest de l'Ile de Vancouver au cours du voyage de poisson du fond, numero 78-3, mars 1978. Il y avait eu une augmentation au-dessus de la moyenne du transport "Ekman" près de la côte pendant janvier, février et mars 1978.

Mots clés: l'eau du haut-fond, température de l'eau, transport "Ekman".

PURPOSE

Temperature data were collected during a groundfish survey conducted off the southwest coast of Vancouver Island during the period February 28-March 10, 1978 (Harling et al. 1978). Stations at which temperature observations were made are shown in Fig. 1. This report includes a summary of the temperature data, and a general assessment of oceanographic conditions that prevailed during this period.

DATA

Temperature profiles were obtained with a mechanical bathythermograph (BT). Sea surface temperatures were taken from a bucket sample, and a few bottom temperatures were obtained in the deeper waters with a reversing thermometer. The temperature profiles were manually digitized, generally at standard depths and/or inflection points. Sea surface temperatures obtained from the bucket samples were used to correct the BT readings. The data are listed in Table 1. The original BT slides are on file at the Pacific Biological Station. Transports were computed by the Fishery Oceanography Program staff.

RESULTS

The METOC sea surface isotherm chart for the period March 5-9 (Fig. 2) indicates that the surface coastal waters were 8-9 C in the offshore area. The METOC 150m isotherm chart for March 2-8 (Fig. 3) indicates that the deeper coastal waters were 8 C. Robinson (1976) gives the mean March surface temperature as 7.5 C and the mean March 150m temperature as 6.5-7.0 C. Sea surface temperatures ranged from 8.4-10.2 C, with the warmest waters occurring in the northern and southern parts of the study area (Fig. 4).

Temperature inversions, positive temperature gradients and near-vertical homogeneity were characteristic features of the vertical temperature structure. These features are typical of the shelf waters off the west coast of Vancouver Island in winter (Lane 1963). The positive temperature structure resulted in a subsurface layer of relatively warm water (9.5-10.3 C) overlying a large portion of the shelf within this area (Fig. 5-7).

The distribution of bottom temperatures indicates that the isotherms parallel the isobaths, with a relatively marked gradient occurring in the southwestern part of the area (Fig. 8). Bottom temperatures ranged from 7.3-10.3 C, with coldest bottom water occurring seaward of the 50 fm (91m) isobath.

DISCUSSION

Temperature conditions encountered during this period are considered to be anomalously warm. An examination of Ekman transport shows that onshore Ekman transport was relatively high in January-March 1978 (Fig. 9). Monthly mean values were similar to those of winter 1958 (Table 2), also an anomalously warm period.

A model of sea water structures off the west coast of Vancouver Island indicates that onshore transport of warm surface waters from the southwest, converging on the coast and sinking is a normal process during winter (Lane 1963). The positive temperature structure is maintained by radiation of heat from the surface layer together with surface dilution by river runoff which overrides the warmer waters from the southwest. It appears that an intensification of these oceanographic processes occurred during late winter, January-March, 1978.

ACKNOWLEDGEMENTS

We thank A. J. Dodimead for his guidance and comments.

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Robinson, M. K. 1976. Atlas of North Pacific Ocean monthly mean temperatures and mean salinities of the surface layer. U.S.N. Naval Ocean. Off., Publ. 2: xix + 173 fig.

Table 1. Temperature profile data recorded at stations shown in Fig. 1

AREA: Southwest Coast-Vancouver Island DATE: March 2-9, 1978 VESSEL: ARCTIC HARVESTER

No.	Day/Mo.	Time (PST)	Position		Bottom depth (m)	Depth (m)/Temperature (°C)														Depth (m) Salinity (‰)	
			Lat. N	Long. W																	
						0	10	13	30	50	75	90	95								
1	2/3	1230	48° 54'	125° 44'	95	8.8	8.9	9.3	9.4	9.4	9.6	9.7	10.1								
						0	5	10	12	15	30	50	65								
2	"	1245	48° 53'	125° 44'	65	8.8	8.8	9.1	9.3	9.1	9.2	9.4	9.5								
						0	5	10	15	25	30	40	50								
3	"	1255	48° 53'	125° 43'	50	8.8	8.8	8.9	9.1	9.1	9.3	9.3	9.6								
						0	7	10	15	28	30	32	50								
4	"	-	48° 51'	125° 43'	50	8.7	8.8	9.0	9.2	9.3	9.2	9.1	9.3								
						0	7	10	15	17	30	40	45	50	57						
5	"	-	48° 49'	125° 42'	57	8.8	8.8	9.3	8.8	8.5	8.5	8.5	8.8	8.9	8.9						
						0	10	30	35	45	50	57									
6	"	1400	48° 48'	125° 41'	57	8.5	8.5	8.5	9.4	9.8	9.8	9.9									
						0	10	20	30	35	50	75	87								
7	"		48° 47'	125° 39'	87	8.5	8.5	8.6	9.8	10.0	10.1	10.3	10.3								
						0	9	10	12	20	25	30	50	75	100	120					
8	"		48° 46'	125° 40'	120	8.9	8.8	8.9	9.3	9.8	10.0	10.1	10.2	10.3	10.2	10.2					
						0	10	30	40	45	50	75	100	112							
9	"	1650	48° 49'	125° 32'	112	8.5	8.3	8.3	8.3	9.6	9.9	10.0	10.0	10.0							
						0	10	30	40	50	65										
10	"	1710	48° 50'	125° 32'	65	8.4	8.3	8.3	8.8	9.2	9.7										
						0	10	18	30	44	50	55									
11	"		48° 52'	125° 33'	55	8.8	8.8	8.5	8.3	8.2	8.5	9.0									
						0	10	30	50	60	75	100									
12	"	1750	48° 53'	125° 34'	100	8.6	9.1	8.8	8.5	8.4	9.7	10.1									
						0	10	12	30	42	50	75	100								
13	"		48° 55'	125° 35'	100	8.7	8.7	9.2	9.0	8.7	9.0	9.6	10.1								
						0	10	20	25	30	34	35	43	50	75	85	96				
14	"		48° 55'	125° 38'	96	8.7	8.7	8.6	9.2	9.1	9.1	9.0	9.2	9.2	9.3	10.0	10.1				
						0	10	12	30	35	50	60	71								
15	"		48° 58'	125° 40'	71	8.8	8.8	9.1	9.3	8.9	8.9	8.9	9.3								

Table 1 (cont'd)

AREA: Southwest Coast-Vancouver Island DATE: March 2-9, 1978 VESSEL: ARTIC HARVESTER

No.	Day/Mo.	Time (PST)	Position		Bottom depth (m)	Depth (m)/Temperature (°C)														Depth (m) Salinity (‰)	
			Lat. N	Long. W																	
16	2/3		48° 58'	125° 43'	74	0	10	15	28	35	50	74									
						8.8	8.9	8.9	9.2	9.0	8.9	9.7									
17	"		48° 57'	125° 46'	64	0	10	30	50	64											
						8.8	9.1	9.3	9.3	9.6											
18	"	2005	48° 56'	125° 45'	102	0	10	15	30	40	42	50	60	65	75	100	102				
						8.7	8.7	9.0	9.2	9.2	9.0	9.1	9.3	9.6	9.8	10.0	10.0				
19	"	2030	48° 56'	125° 49'	63	0	10	18	20	30	50	55	60	63							
						8.7	8.7	8.7	9.1	9.1	9.1	9.4	9.9	9.9							
20	4/3	0745	48° 51'	126° 05'	88	0	5	10	25	30	50	75	88								
						8.5	8.8	8.9	8.5	8.7	9.6	9.9	9.7								
21	"	0850	48° 51'	126° 00'	75	0	5	10	30	40	50	60	75								
						8.6	8.9	9.0	9.0	8.9	9.6	9.8	10.0								
22	"	1055	48° 48'	125° 57'	80	0	10	30	40	50	75	80									
						8.6	8.6	8.6	9.6	9.9	10.0	10.0									
23	"	1150	48° 45'	125° 51'	87	0	10	30	33	50	75	87									
						8.8	8.8	9.0	9.5	9.7	9.7	10.0									
24	"	1215	48° 44'	125° 48'	150	0	10	30	50	59	63	75	100	125	135						
						9.2	9.2	9.6	9.7	9.7	10.1	10.1	10.1	10.0	10.0						
25	5/3	0740	48° 29'	125° 44'	106	0	10	30	50	75	100	100									
						9.8	9.8	9.8	9.6	9.4	9.1	9.1									
26	"	0845	48° 26'	125° 51'	141	0	10	30	50	75	100	125	135								
						9.6	9.5	9.5	9.3	9.1	8.9	8.3	8.2								
27	"	0930	48° 25'	125° 55'	183	183															
						7.29*															
28	"	1700	48° 40'	125° 23'	65	0	10	30	40	50	65										
						9.1	8.9	8.5	9.2	9.4	9.5										
29	"	1740	48° 42'	125° 28'	113	0	10	20	30	50	75	100	113								
						8.6	8.6	8.4	8.7	9.3	9.6	10.0	10.0								
30	"	1810	48° 43'	125° 33'	107	0	10	15	30	50	55	75	100	107							
						8.8	8.7	8.5	8.5	9.7	10.0	9.9	9.8	9.8							

Table 1 (cont'd)

AREA: Southwest Coast-Vancouver Island DATE: March 2-9, 1978 VESSEL: ARCTIC HARVESTER

No.	Day/Mo.	Time (PST)	Position		Bottom depth (m)	Depth (m)/Temperature (°C)															Depth (m) Salinity (‰)	
			Lat. N	Long. W																		
31	5/3	1845	48° 44'	125° 36'	185	185 9.79																
32	7/3	1635	48° 58'	126° 11'	94	0 10.1	10 10.0	30 9.9	50 9.8	75 9.7	94 9.7											
33	"	2030	48° 46'	126° 17'	128	0 9.4	10 9.4	30 9.3	50 9.3	75 9.3	100 9.3	125 9.2	128 9.2									
34	"	2130	49° 00'	126° 05'	66	0 10.0	10 10.0	30 10.0	50 9.9	66 9.9												
35	"	2200	49° 01'	125° 58'	40	0 9.4	10 9.5	30 9.7	40 9.7													
36	8/3	1230	48° 55'	125° 42'	97	0 9.0	10 8.6	30 8.7	50 9.0	65 9.3	75 9.6	97 9.6										
37	"	1245	48° 56'	125° 42'	56	0 8.8	10 8.6	30 8.6	45 9.0	50 9.3	56 9.5											
38	"	1510	48° 51'	125° 31'	114	0 8.9	10 8.8	23 8.5	30 8.5	50 8.5	70 8.5	75 8.8	100 9.5	114 9.7								
39	"	1530	48° 50'	125° 33'	48	0 9.2	10 8.6	30 8.7	40 8.9	45 9.0	48 9.1											
40	"	1600	48° 49'	125° 35'	68	0 9.1	10 8.8	13 8.4	30 8.4	50 8.5	68 9.0											
41	"	1630	48° 50'	125° 39'	53	0 9.1	10 8.9	30 8.5	38 8.5	45 9.1	50 9.1	53 9.1										
42	"	1705	48° 51'	125° 44'	55	0 9.0	10 9.0	30 9.0	50 9.0	55 9.0												
43	9/3	0745	48° 45'	125° 47'	118	0 8.8	10 9.2	30 9.5	50 9.6	75 9.8	100 9.8	118 9.8										
44	"	0755	48° 42'	125° 51'	73	0 9.1	10 9.1	20 9.5	30 9.6	50 9.6	73 9.8											
45	"	0830	48° 39'	125° 56'	95	0 9.2	10 9.2	13 9.3	30 9.8	50 9.9	75 9.8	95 9.8										

Table 1 (cont'd)

AREA: Southwest Coast-Vancouver Island DATE: March 2-9, 1978 VESSEL: ARCTIC HARVESTER

No.	Day/Mo.	Time (PST)	Position		Bottom depth (m)	Depth (m)/Temperature (°C)										Depth (m) Salinity (‰)	
			Lat. N	Long. W		0	10	30	45	50	75	90	100	125	141		
46	9/3	0915	48°35'	126°03'	141	9.1	9.1	9.2	9.6	9.6	9.5	9.3	9.0	8.7	8.6		
						0	152										
47	"	0940	48°33'	126°06'	152	9.2*	7.98*										
						0	192										
48	"	1010	48°31'	126°09'	192	9.3*	7.48*										

* Reversing thermometer.

TABLE 2

EKMAN TRANSPORT NORMAL TO THE COAST AT 47°N, 126°W

Year	Transport 10 T/sec/km		
	January	February	March
1958	92.5	88.2	18.3
1978	86.8	93.6	16.2
1955-1978 mean	25.7	22.2	-7.6

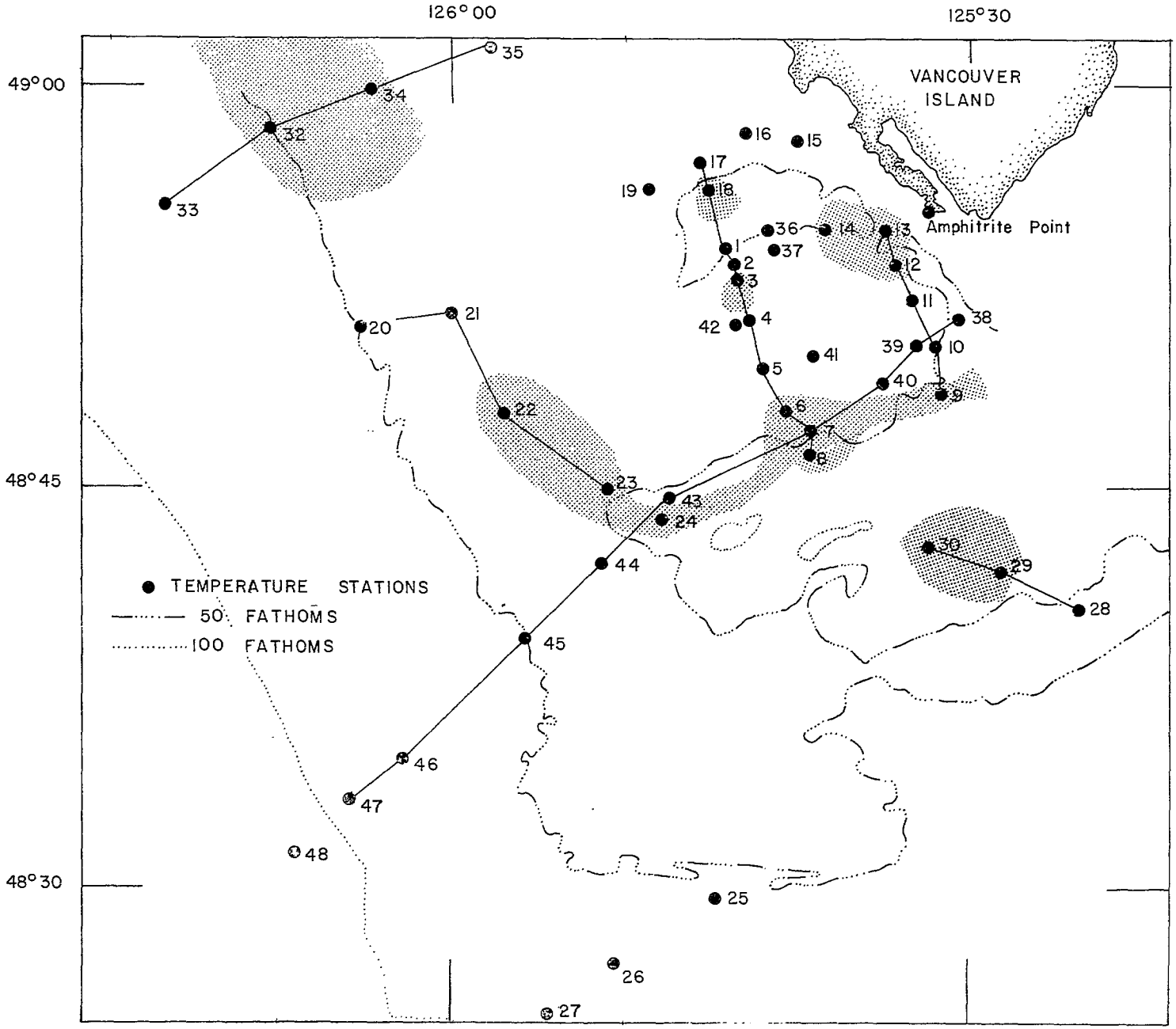

Fig. 1. South West Vancouver Island (Approach to Barkley Sound) with the shaded area showing the approximate boundary of water greater than 10 C. Temperature stations and lines for which temperature profiles are given are indicated.

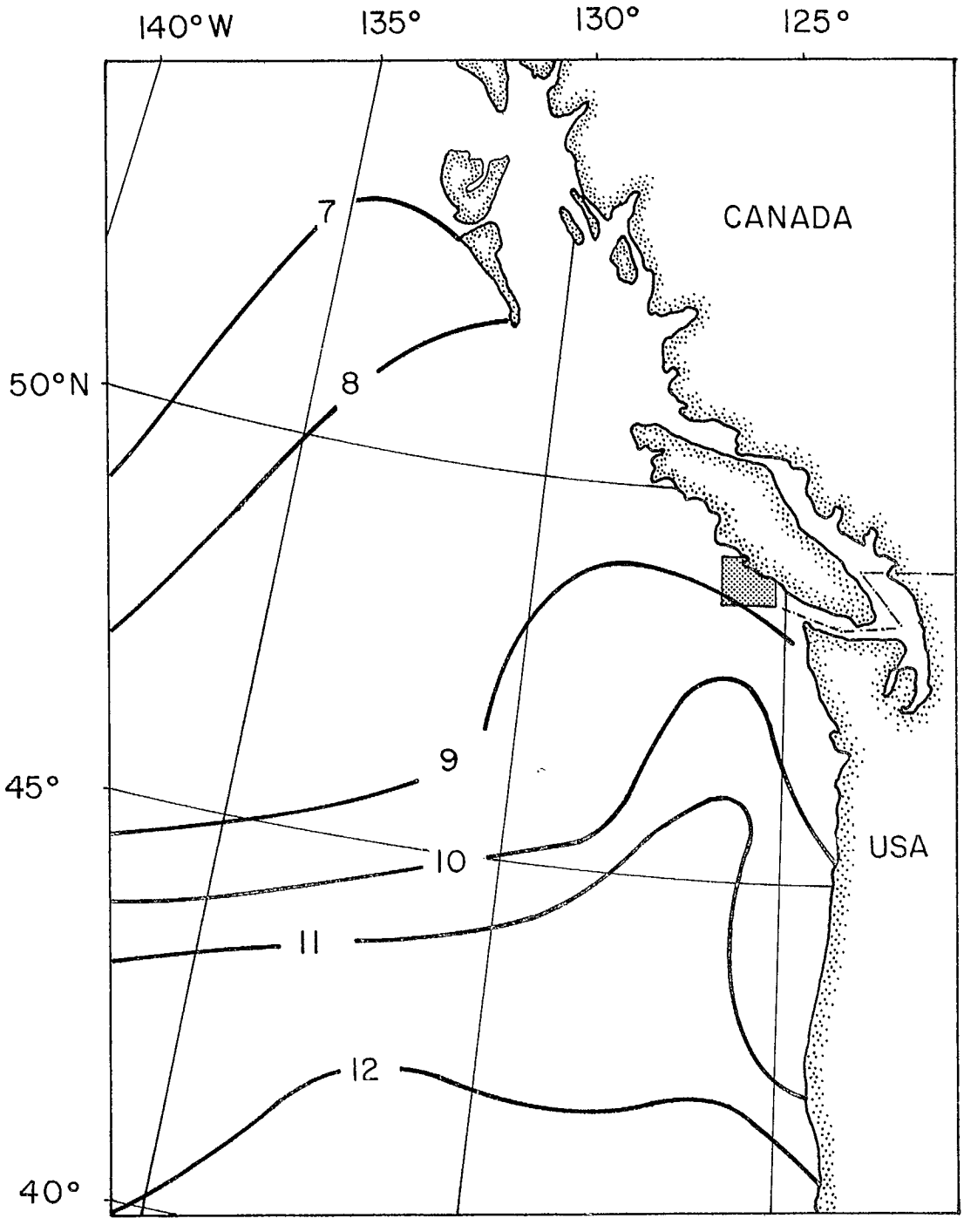

Fig. 2. METOC Sea Surface Isotherm Chart for March 5-9, 1978.

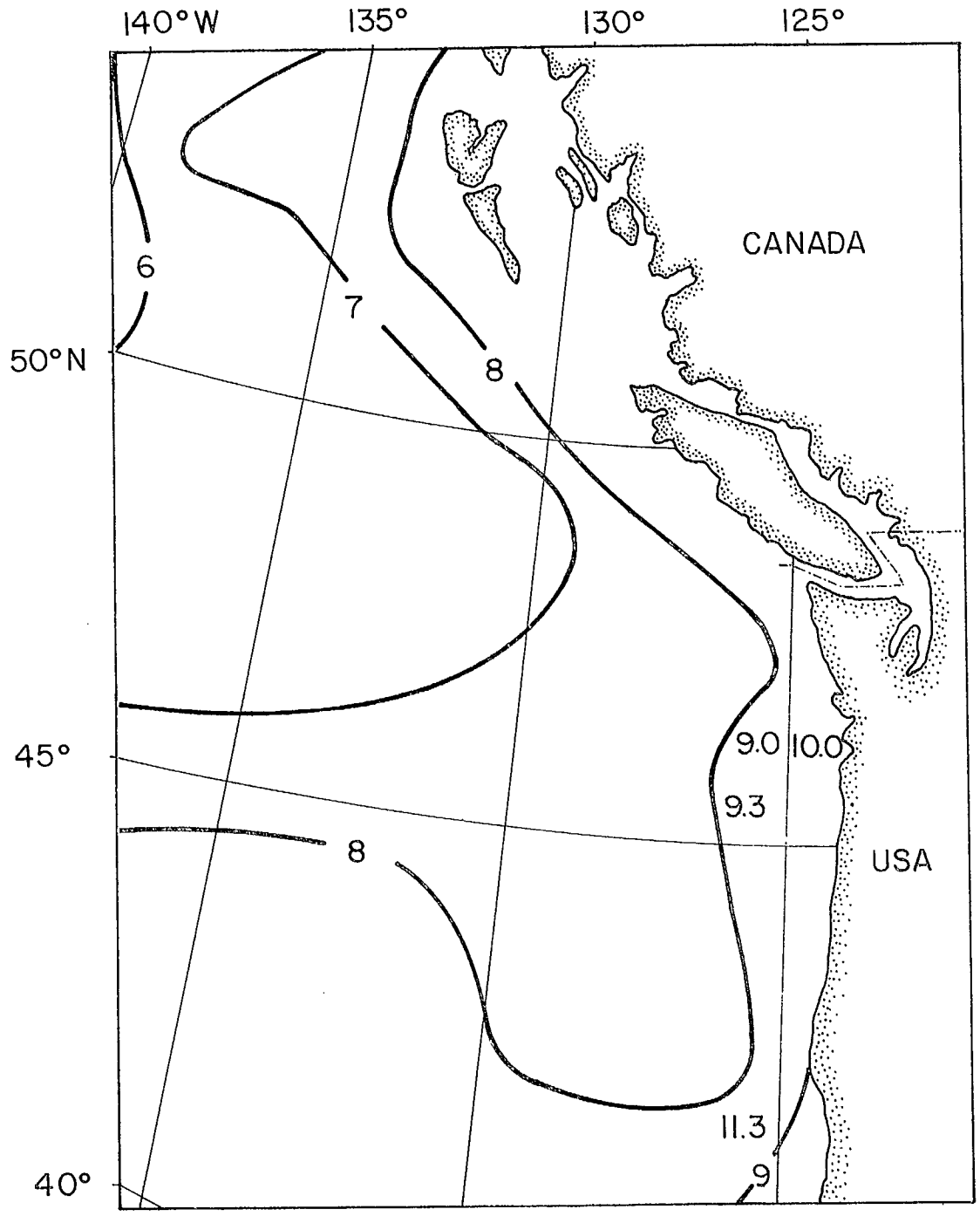

Fig. 3. METOC 150 Meters Isotherm Chart for March 2-8, 1978.

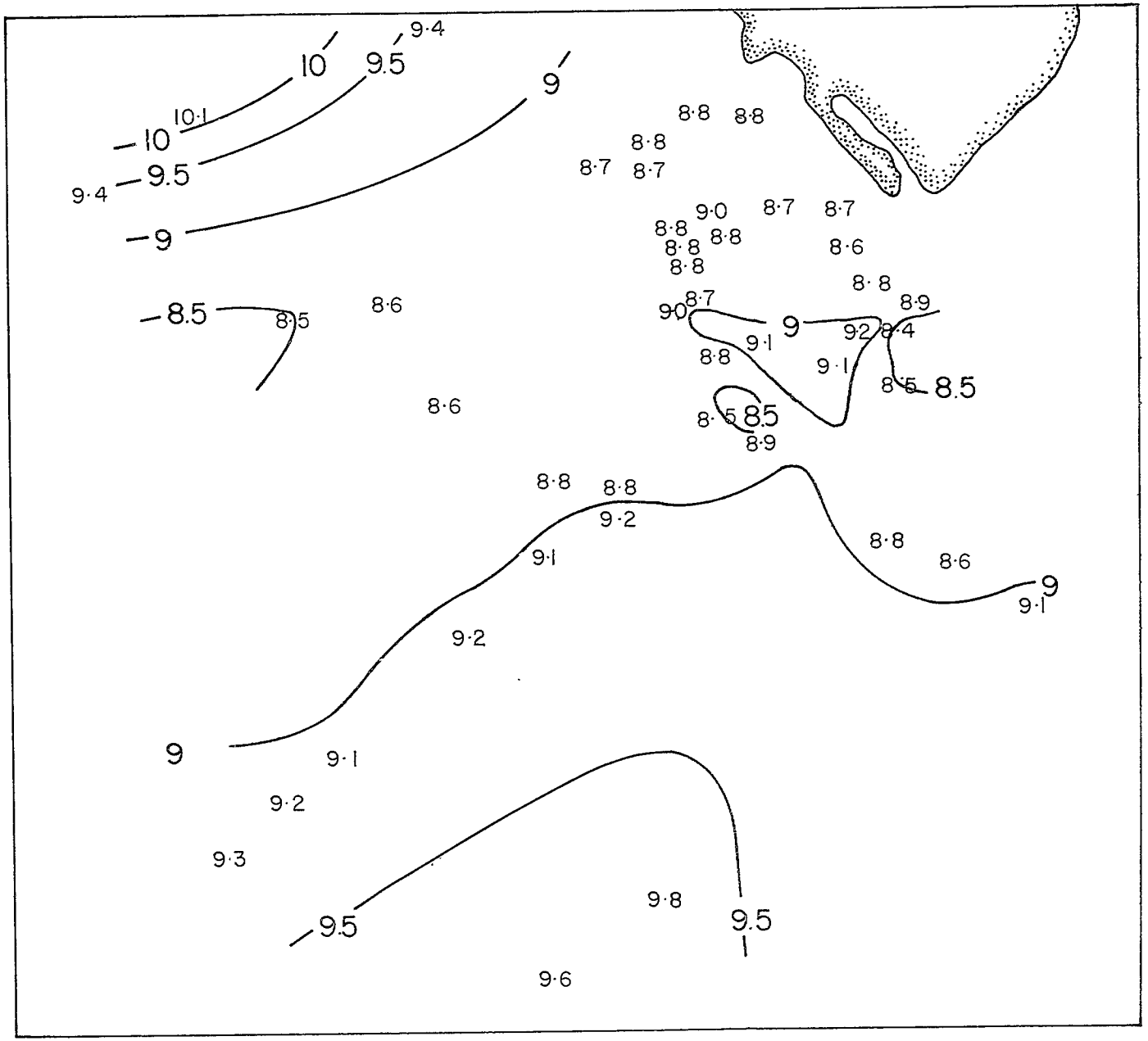

Fig. 4. Surface temperatures and isotherms.

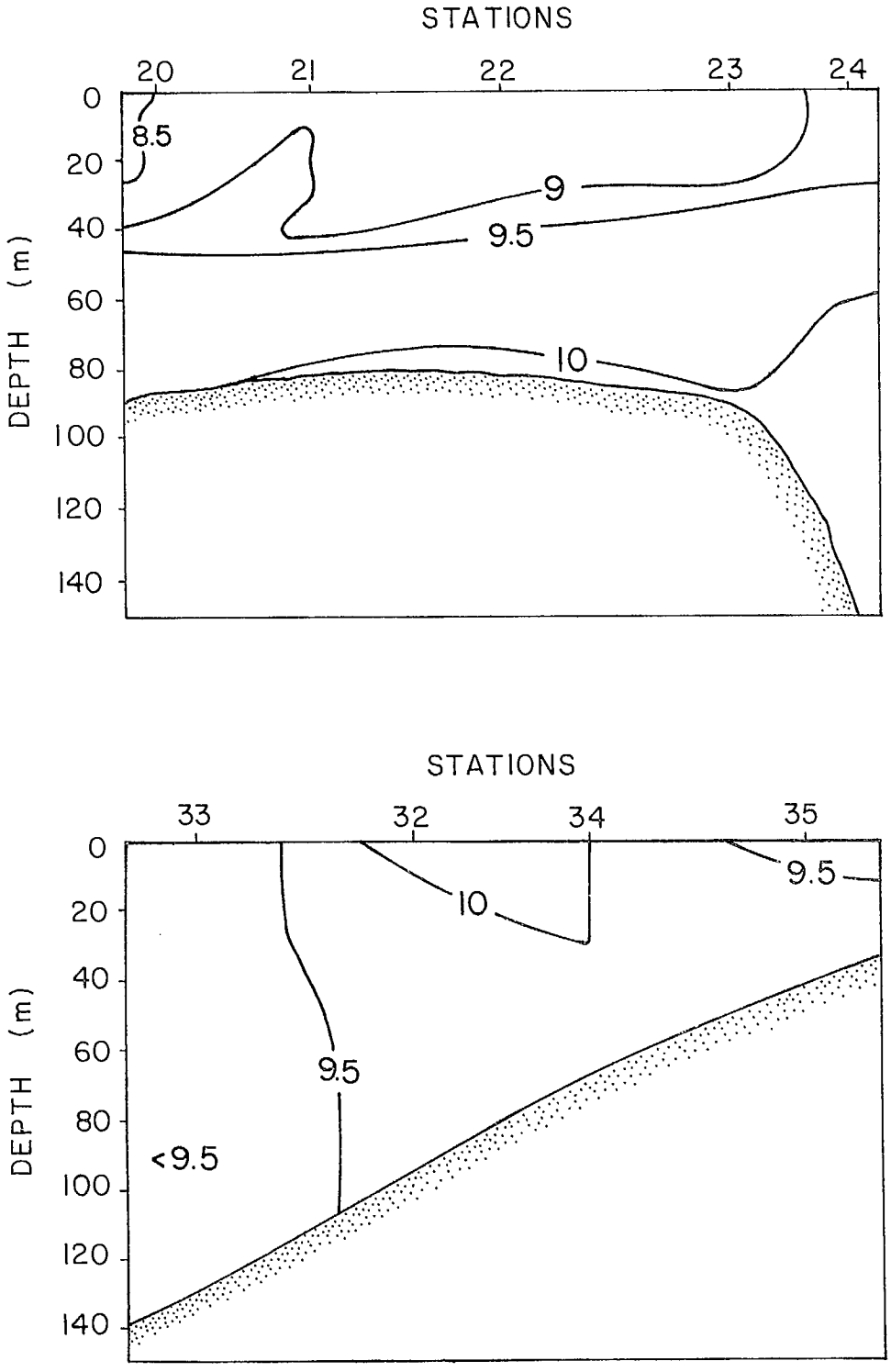

Fig. 5. Vertical sections of temperatures (C), stations 20-24, 33-35.

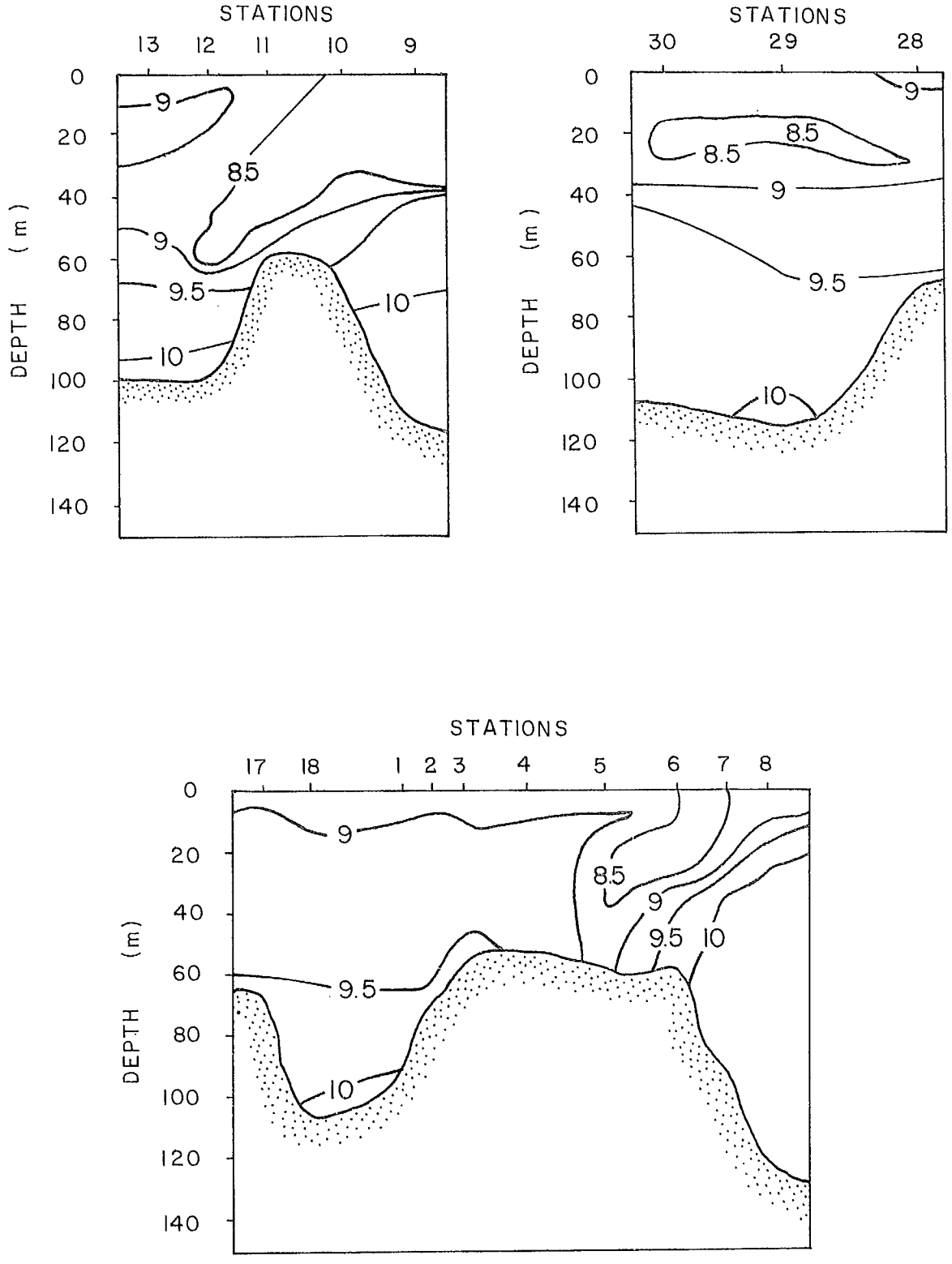

Fig. 6. Vertical sections of temperatures (C), stations 9-13, 28-30, 8-17.

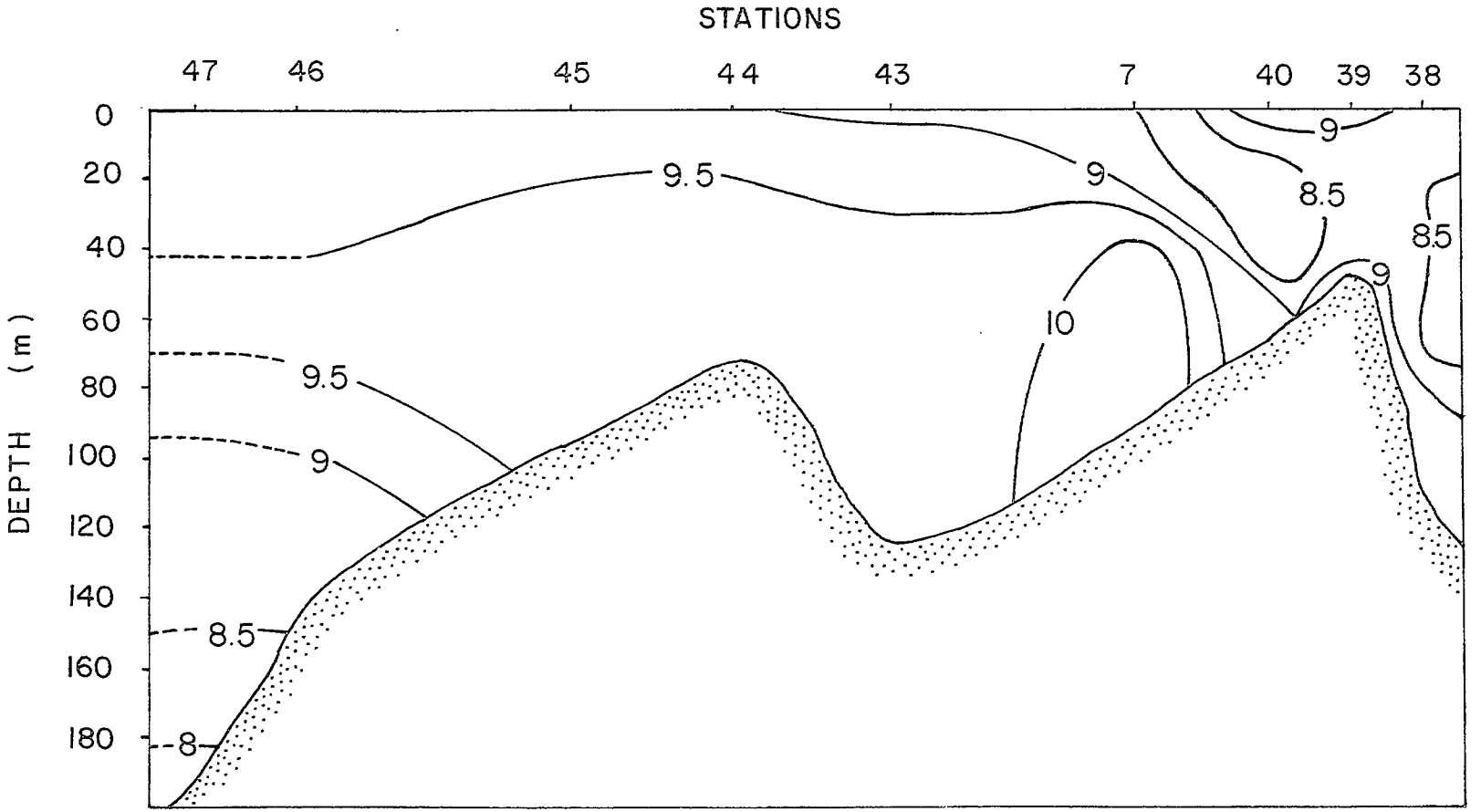

Fig. 7. Vertical section of temperatures (C), stations 38-47.

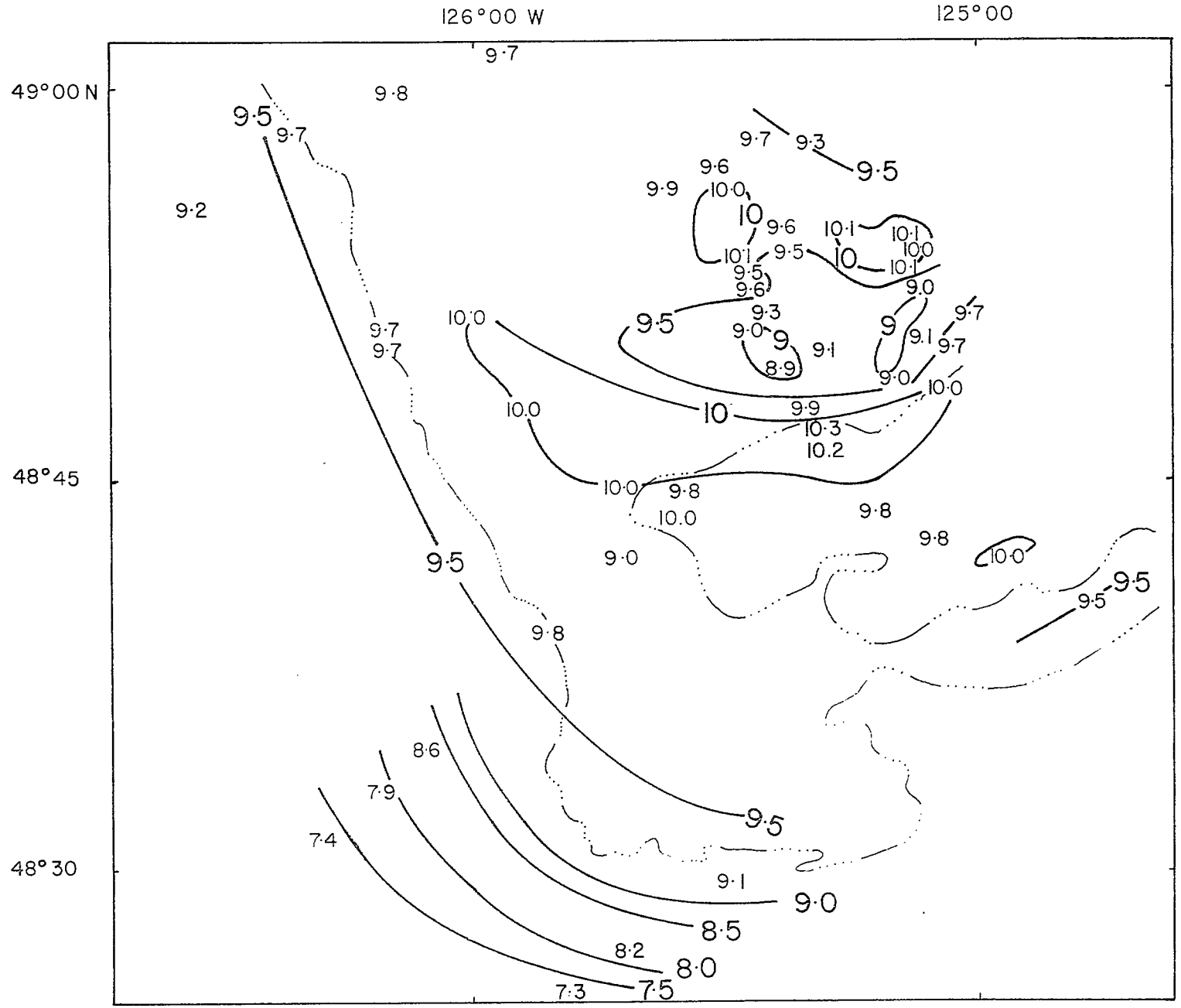

Fig. 8. Bottom temperatures and isotherms.

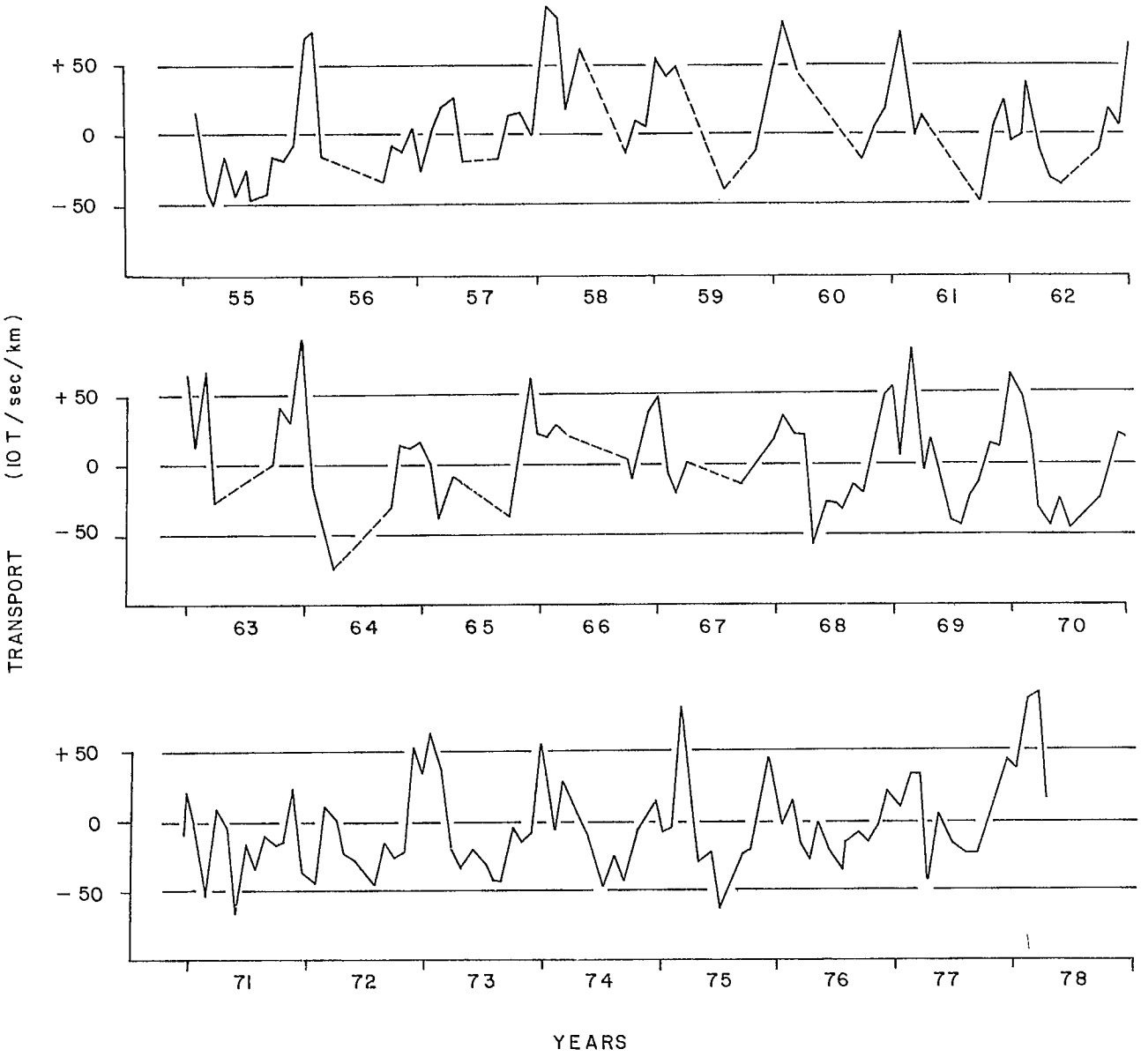

Fig. 9. Ekman transport normal to the coast from 035° at 47° N, 126° N for 1955-1978.