U.S. DEPARTMENT OF THE INTERIOR

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METHANE IN COASTAL SEA WATER, SEA ICE, AND BOTTOM SEDIMENTS, BEAUFORT SEA, ALASKA

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Contents

Abstract

This report summarizes data acquired from 1990 to 1994 for the gas-hydrate portion of the USGS project "Permafrost and gas hydrate as possible sources of methane" of the USGS Global Change and Climate History program. The objective of this project has been to test the hypothesis that gas hydrate deposits of the Beaufort Sea continental shelf are destabilized by the ~ 10°C temperature increase that has resulted from the Holocene transgression of the Arctic Ocean. To test this idea we have selected an area off the north coast of Alaska centered on Harrison Bay. We have measured the concentration of methane in surficial sediments, in the water column when ice is present and absent, and in seasonal sea ice. Our results show that more methane is present in the water when ice is present than when ice is absent, and that methane is also present within the ice itself, often at higher concentrations than in the water. Thus the Beaufort Sea shelf of Alaska is a seasonal source of methane. The primary source of this methane has not yet been defined, but gas hydrate is a reasonable candidate.

Introduction

Methane is an important trace component of the atmosphere. Its concentration is increasing at a rate of about 0.9% per year (Khalil and Rasmussen, 1983; Steele et al., 1987; Blake and Rowland, 1988), although this rate has decreased recently (Steele, et al., 1992). Because methane is radiatively active, it is a "greenhouse" gas that has a global warming potential 20 times larger than an equivalent weight of carbon dioxide when integrated over a 100-yr span of time (Shine et al., 1990). The earth's atmosphere has a wide variety of sources and sinks for methane (Cicerone and Oremland, 1988), including gas hydrate. Gas hydrate exists in metastable equilibrium with its environment and is affected by changes in pressure and temperature. The amount of methane that is trapped in gas hydrate is perhaps 3,000 times the amount in the atmosphere. A large release of methane from this source could have a significant impact on atmospheric composition and thus on the radiative properties of the atmosphere that affect global climate (MacDonald, 1990).

Gas hydrate deposits of polar continental shelves are currently believed to be the most vulnerable to climate change (Kvenvolden, 1988). These areally extensive shelves, formerly exposed to very cold surface temperatures (yearly average -10° to -20° C) have been and are being transgressed by a much warmer polar ocean (~0° C). As a result, the polar shelf surface in water depths greater than 5 m, has experienced an approximately 10° C or more temperature increase over the past 10,000 years. Although pressure on shelfal gas hydrate deposits has increased owing to a rise in sea level of about 100 m, this pressure increase which would stabilize the gas hydrate, is more than offset by the large temperature increase that destabilizes the gas hydrate. The amount of methane released by this process has been estimated to be about 4 Tg (10^{12} grams) year^{-1} (Kvenvolden, 1991) or about 1% of all current sources of atmospheric methane. If this suggestion and estimate are correct, then escape of methane from gas hydrate deposits of polar continental shelves should be observable. To test this idea, beginning in 1990 we conducted surveys of methane in sediment, water, and ice in an area of the Beaufort Sea continental shelf offshore from the north coast of Alaska. Previously, measurements of atmospheric methane concentrations at Barrow, Alaska, about 200 km NE of the study area, showed a seasonal increase during August through October, perhaps due in part to methane venting from Arctic shelfal waters (figure 1). This report summarizes our data collected from 1990 through 1994.

Methods

In our survey, we measured methane concentration in sea water under the ice on six primary transects from nearshore to the shelf break at water depths ranging from 2.5 to 88 m from Cape Halkett east to Mikkelsen Bay, Alaska (figure 2). Other surface water samples were taken at various locations where water depths ranged from 2 to 20 m within the area between Camden Bay and the Colville River Delta (figure 2). One oceanic surface water sample was also collected in April 1993 at 72° 38' N. latitude . The surveys were undertaken during the last week of April and first week of May 1992, the middle of April 1993, the latter portion of April 1994, the second week of September 1993, and the later portion of August 1994. At each station in April and May, a 23-cm diameter hole was drilled through the 2-m thick first-year ice. Niskin bottles (1.7 L) were attached at intervals to a line lowered to the seafloor and subsequently tripped to collect water samples for methane determinations. In September 1993 and August 1994, when no ice was present, a boat was used to transit to stations. As each Niskin bottle was recovered, 100 cm^3 of water was transferred to a 140 cm^3 syringe. A heat lamp to prevent the water from freezing during April and May surveys. In the laboratory at the end of each day's field work, 40 cm^3 of ultra-pure nitrogen were added to each of the syringes, and methane was extracted from the water into the nitrogen at room temperature by shaking the syringe, following a method modified from McAullife (1971). A portion of the resulting gas mixture was measured for methane content by gas chromatography. Multiple extractions were used on several samples to determine an empirical extraction efficiency coefficient which was utilized with the remainder of the samples that were extracted only once. Our analyzed gas standard contained 10 ppm ± 2% methane in nitrogen. Duplicate samples were analyzed for each water depth with an average standard deviation of ± 0.6 nM.

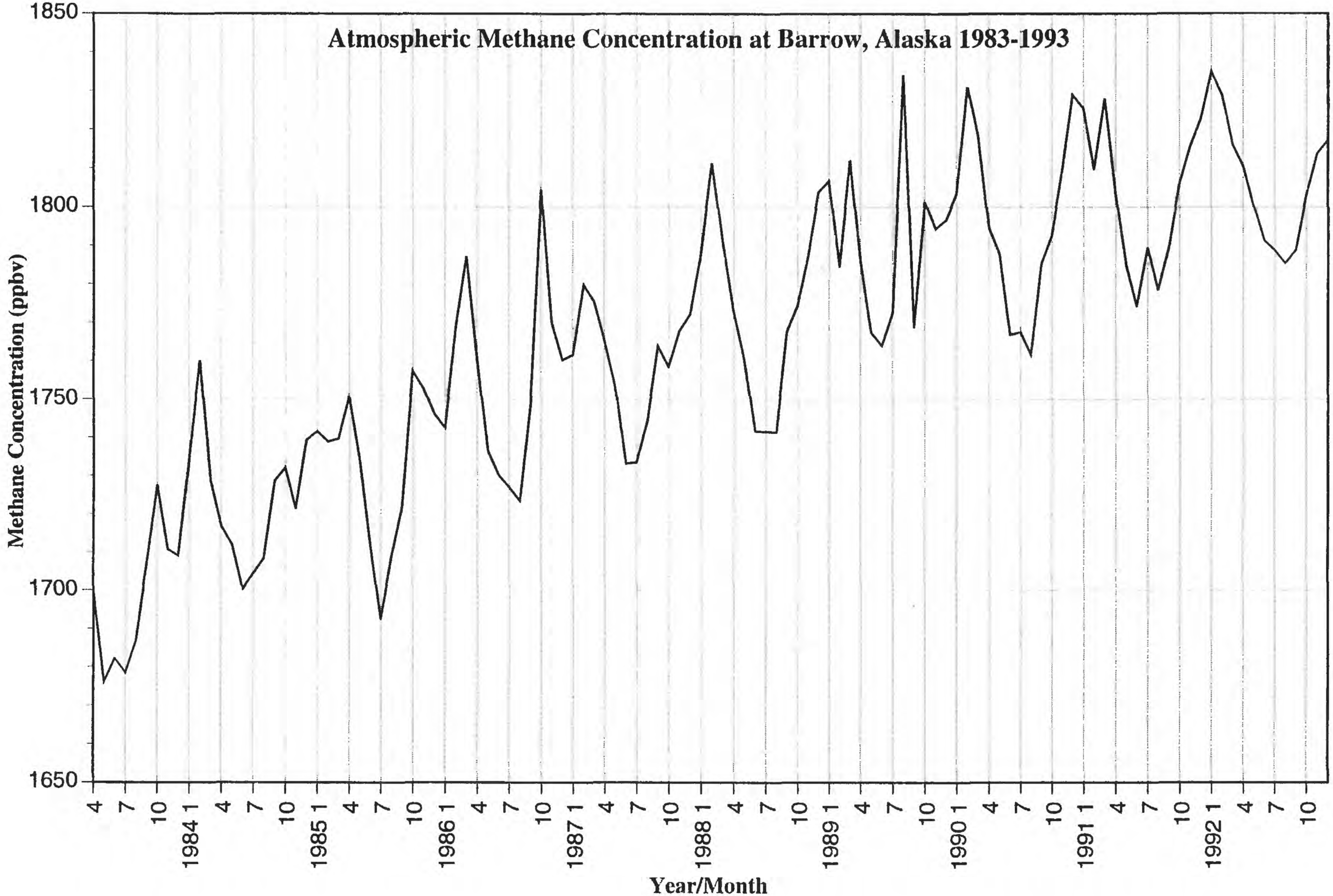

Fig. 1. Mean monthly atmospheric methane concentration (ppb-v, parts per billion) measured at Barrow, Alaska from 1983-1993. Measurments are made by the National Oceanic and Atmospheric Administration (NOAA), Climate Monitoring and Diagnostics Laboratory (CMDL).

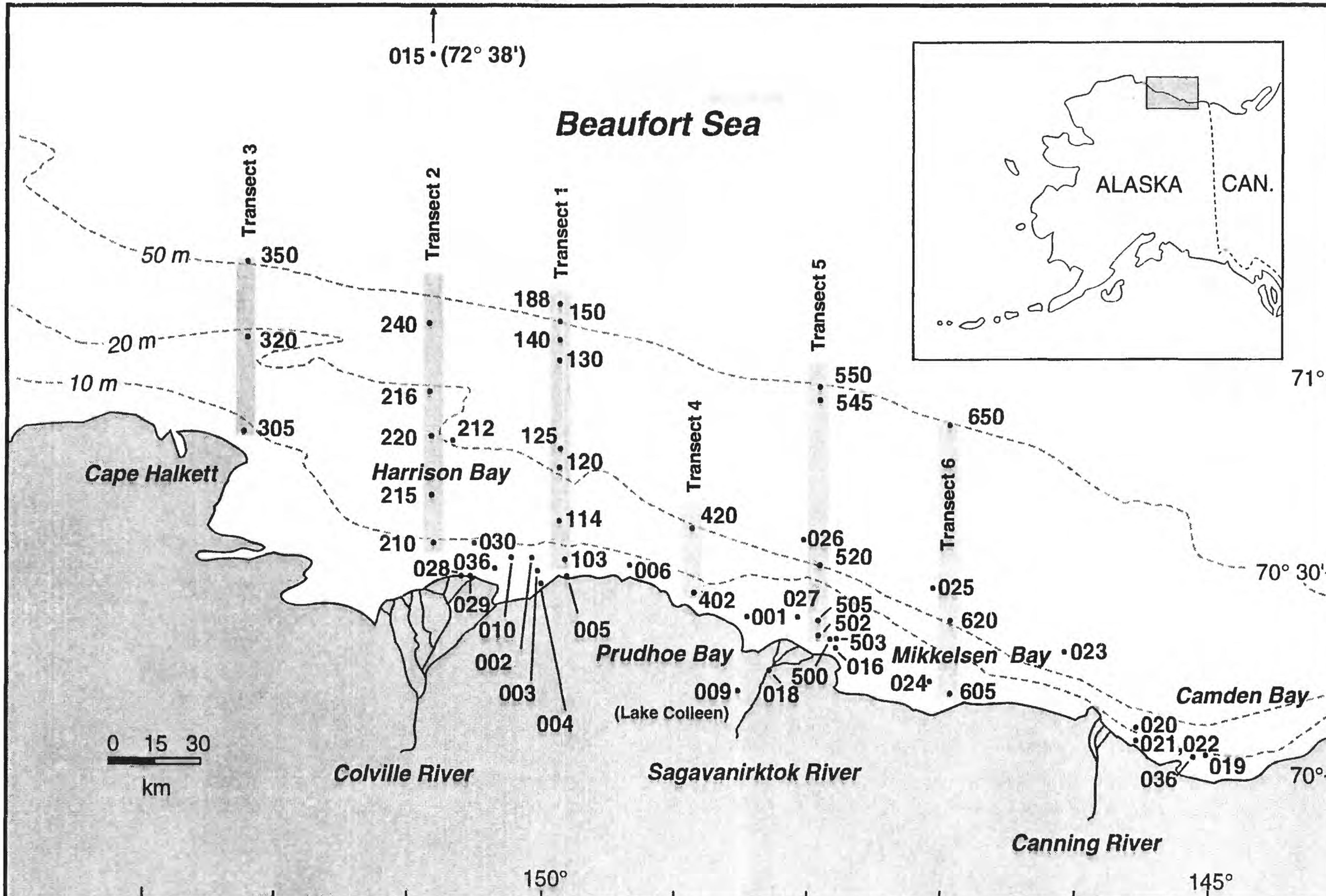

Fig. 2. The study area showing six north-south transects with the water and ice station locations.

CTD (conductivity, temperature, depth) casts were made at each station. CTD data was recorded internally by a Seacat 19 CTD probe made by Sea Bird of Seattle Washington. The data was downloaded onto a computer where it was processed using Seasoft Version 4.016. The sub-programs LOOPEDIT, BINAVE, then DERIVE were utilized to process the raw data. The data were averaged into 0.5 m intervals. The upcast and downcast were evaluated, and only one cast is plotted. In general the upcast was used because the sensors showed less fluctuation. The results are plotted for each station and appended with water methane concentrations in Appendix 1.

The methods utilized to measure nutrients in this study were adapted from older colorimetric procedures and are described in detail by Whitledge and others, (1981). A basic description of each method, conducted on a Technicon Autoanalyzer System, follows.

Phosphate is determined as phosphomolybdic acid which in its reduced form in the presence of antimony has an absorption maximum at 880 nm. The method is basically an automated version of the procedure of Murphy and Riley (1962).

Orthosilicic acid is determined by its reaction with molybdate in aqueous acidic solution to form silicomolybdic acid. In this procedure, which is basically that of Armstrong and others, (1967), stannous chloride is used to reduce silicomolybdic acid to the heteropolic acid which has an absorption maximum at 820 nm.

Nitrite is determined by the Greiss reaction in which sulfanilamide and N-(1-Napthyl)ethylenediamine dihydrochloride react with nitrite in aqueous acidic solution to form an intensely pink diazo dye with an absorption maximum at 540 nm (Bendschneider and Robinson, 1952). Nitrate, after it is reduced to nitrite by passage through a column of copperized cadmium filings, is determined in an identical manner to nitrite (Wood and others 1967). This analysis gives the sum of nitrate + nitrite, and nitrate is determined by difference.

Ammonium is determined by the Berthelot reaction in which hypochlorous acid and phenol react with ammonium in aqueous alkaline solution to form indophenol blue, an intensely blue chromophore with an absorption maximum at 637 nm. The method utilized is a modification of the procedure reported by Slawyk and MacIsaac (1972).

The methane content of sea ice was measured at 51 stations in 1993 and 1994. A 1 m long by 7.6 cm diameter ice corer with an extension was used to core through the ice to sea water. The ice core was laid out on the sea ice, measured and cut into 10 cm sections. Selected intervals were chosen, then placed in 1-liter friction sealed cans equipped with 2 septa ports, sealed, and kept frozen. At the field laboratory, each sample was weighed, then the headspace within the can was purged with ultra pure nitrogen for 5 minutes at flow rates exceeding 200 ml/min. Tests on the methane content of the purged headspace with the frozen ice core inside yielded concentrations less than 0.1 ppm. The cans containing ice samples were placed in hot water baths and stabilized at approximately 20° C. Each can was shaken by hand for about 30 seconds to partition the dissolved methane between the water and the nitrogen headspace. Next, a syringe containing 30 ml of ultra pure grade nitrogen was injected into the can, then 30 ml of the resulting mixture of headspace and gas was removed and analyzed for methane content in the same manner as described for sea water samples. The volume of headspace in the can was determined by the weight of the ice sample, assuming that once melted the water occupied a volume of 1 ml/gm.

Sediment samples were taken in May 1990 operating from the ice canopy. A hole was augured in the ice, through which a 45 x 7.5 cm core barrel with an auger cutting head was lowered. The core barrel was attached to 1.5-m long connecting stems in series up to a maximum length of 15.5 m. Once on the ocean bottom, the core barrel was rotated by hand with the aid of a T bar until no further penetration was achieved. Upon retrieval, the liner containing sediment was extruded onto the ice. The least disturbed 10-cm long (a volume of about 450 ml wet sediment) section of the core was chosen and placed in a septa-equipped 1-liter sample can. Seawater was added to the brim of the can, then 200 ml of water was removed, creating a 200 ml headspace. About 2-3 grams of sodium azide was added as a biocide. The can was sealed, then purged with helium at a flow rate estimated to be greater then 300 ml/min. for 5 minutes. The samples were kept frozen until analysis at our Menlo Park laboratories.

Results

Stations in water depths from 2.5 to 88 m were established on six north-south transect lines as shown in figure 2. Three digit, abbreviated station numbers are shown on the transect lines. Many stations were reoccupied on subsequent surveys. Each station is given 3 additional numbers making a total of six digits per station. The first two refer to the year, the third to the month of sample collection, the fourth to the transect number, and the last two represent the approximate water depth at each station. For example, station 925150 can be read as 1992, May, Transect 1, at 50 meters water depth. When the same station was reoccupied on a subsequent survey only the first 3 digits change denoting a different sampling date; i.e., 934150 was completed in April, 1993. Stations off transect lines are given a 0 in the fourth digit place.

Water Methane Concentrations

Water methane concentrations and methane oxidation rates are listed in Table 1, and are illustrated by graphs of methane vs. water depth at each transect in Appendix 2. Measurements of methane in ice-covered sea water were made in May 1992 , April 1993, and April 1994. The results are compared with measurements taken in ice-free water during September 1993 and August 1994.

Analyses of 143 samples from ice-covered waters demonstrate that methane concentrations in the water column are supersaturated with respect to the equilibrium solubility of methane with the atmosphere (~4 nM). Maximum methane concentrations at a given station ranged from 12 to 275 nM and were typically about 15 to 25 nM throughout the water column. The highest methane concentrations were found near the bottom. Maximum methane concentrations are given in map view for each survey in Appendix 3.

Methane concentrations from ice-free water were determined in 103 samples. Maximum methane concentrations at a given station ranged from 5 to 44 nM with one anomalous measurement of 148.6 nM at station 948120, 18 m water depth. Anomalous methane concentrations (33.7-94.4 nM) were also observed at this same station, 925120 throughout the water column in May, 1992. Typically, methane concentrations were at a minimum at the surface, remained nearly constant or increased with depth to concentrations ranging from 9 to 56.4 nM, excluding the 148.6 nM anomaly mentioned above. Methane concentrations in the upper 3 m of ice-free water never exceeded 18 nM and were commonly between 6 and 14 nM.

A limited number of measurements of the carbon isotopic composition of methane were made at the University of Hawaii. The results shown in Table 1 reveal a wide range of values from -31.1 to -80.5 ‰.

Methane Oxidation rates were determined in selected samples (Table 1) and are given graphically in Appendix 4. The rates during ice covered times were higher than most measurements made worldwide. In ice free periods measured to date (September, 1993), the oxidation rates were undetectable. Thus a seasonality exists regarding the oxidation of methane by bacteria living in the water column.

Nutrients in water

The nutrients, phosphate (PO_4), silica (Si), ammonium (NH_4), nitrite (NO_2), and nitrate (NO_3) were measured at many stations throughout the study period. At this time only the data from the May 1992 survey is listed in Table 2.

Methane in ice cores

We measured the methane content of samples from the ice canopy in April 1993 and 1994. Typically coastal sea ice inshore from 15 m water depth initially forms as a mobile mass of frazil and brash ice a few decimeters thick. This mass gradually solidifies into granular "fast" or stationary ice by late fall. Subsequently the fast ice grows to a thickness of about 2 m over a fixed point on the seafloor. Ice seaward of about 15 m water depth (the seasonal ice pack) is formed in a similar manner but is subject to intense deformation and is mobile throughout the winter. Thus, fast ice is most likely to trap methane in transit from sea water to the atmosphere at a fixed location, whereas offshore ice most likely traps methane from non-fixed locations as it thickens.

We sampled fast ice and seasonal pack ice at 36 locations along the coast from Harrison Bay to Camden Bay in water depths ranging from 1.8 to 57 m. Maximum methane concentrations are given in Appendix 5 and the complete results are listed in Table 3. Methane concentration profiles along transects are given in Appendix 6.

Methane concentration profiles through the ice within the upper 50 cm interval and from water depths less than about 10 m contained the highest concentrations of methane (7 to 1260 nM), with typical values of about 30 to 40 nM. In the ice interval from 50 to 200 cm, the methane concentration ranges from 5 to 286 nM, with typical values of about 15 nM.

Ice that formed in water depths greater than 15 m shows the same trend of decreasing methane with increasing depth in the ice core; however, the methane concentrations were less varied and were always lower. Within the 0 to 50 cm interval methane concentrations ranged from 8 to 14 nM and from 5 to 14 nM within the 50 to 200 cm interval. Measurements of the carbon isotopic composition of methane in ice are shown in Table 3 and reveal a wide range of values from -52.1 to -83.4 ‰.

Methane in sediments

In May 1990, our initial study of gas sources in Harrison Bay concentrated on surficial sediments. It was thought that if methane from destabilized gas hydrates were accumulating and migrating, the gas would transit through the sea floor. As a guide to sampling locations we reviewed the work of Neave and Sellman (1982), who seismically mapped subsea (drowned) permafrost and shallow gas anomalies. These mapped areas and our measured methane concentrations in sediment are shown in figure 3. Our working model of gas hydrate occurrence in permafrost (Kvenvolden, 1988) requires that gas hydrate and permafrost coexist. Holocene sea level rise has, within the last 10,000 years, flooded the area now know as Harrison Bay. About a 10° C temperature rise over this area has initiated a downward migrating thermal pulse capable of melting permafrost and destabilizing gas hydrate. With the additional thermal insulation of the ocean, the geothermal gradient creeps upward and causes an upward migration of warmer temperatures (Lachenbruch and others, 1988). Ostercamp and Fei (1994) have shown that the combined effect of the temperature increases above and

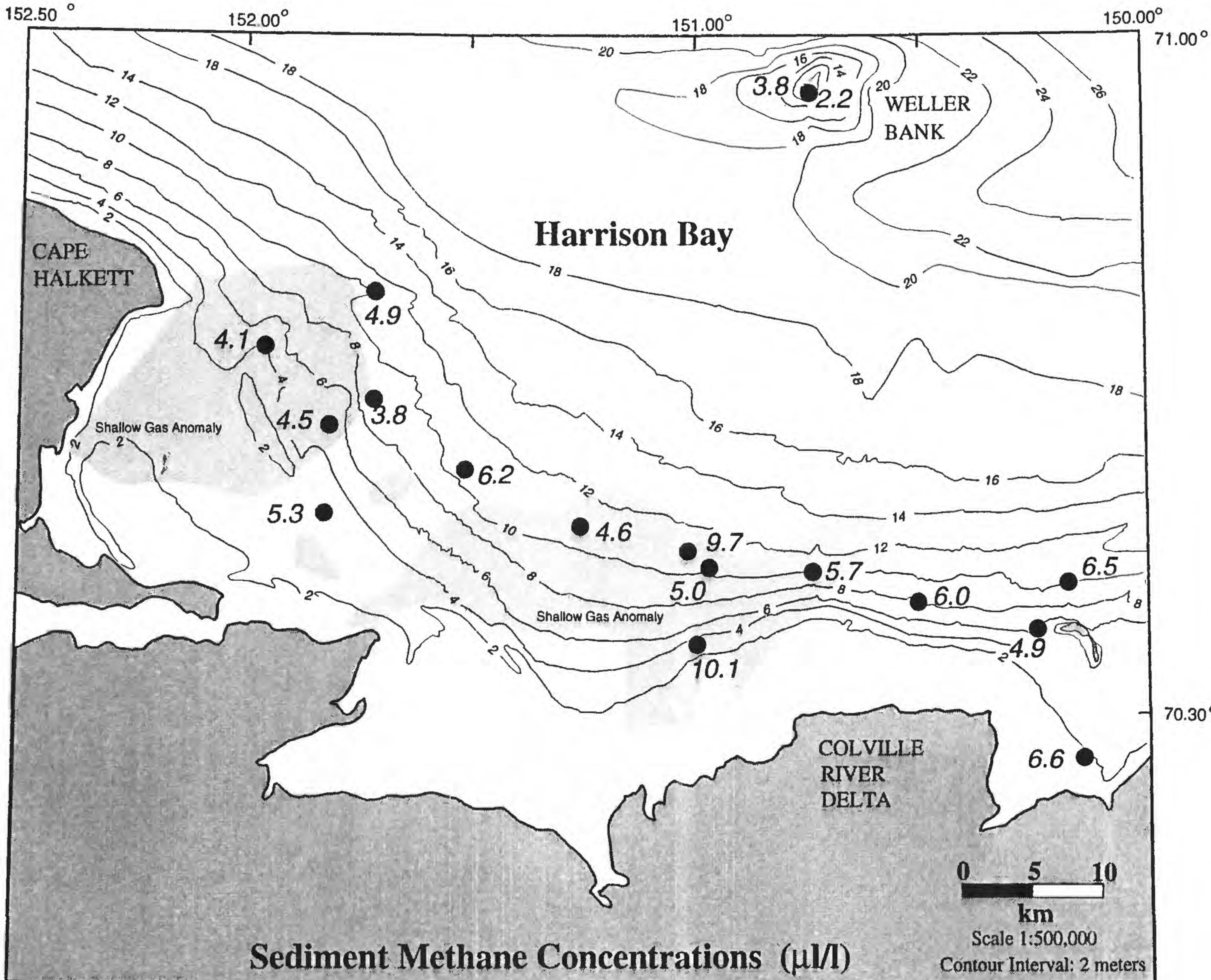

Fig. 3. Methane concentrations in sediment (µl/l, microliters methane per liter wet sediment) measured in May, 1992. Shallow gas anomalies taken from Neave and Sellman, (1982).

below the permafrost should have begun to melt the outer portions of the subsea permafrost, corresponding to approximately the 20 m isobath.

Methane concentrations range from 2.2 to 10.1 μl/l wet sediment. There is no distinctive pattern of methane concentration. However the highest concentrations were recorded within the confines of one mapped shallow gas anomaly. The highest concentrations are found near the Colville River Delta and range from 4.6 to 10.1 μl/l. The lowest concentrations of methane (3.8 and 2.2 μl/l) were found offshore at Weller Bank in clean sand. This low concentration is perhaps the result of methane escaping more readily from the clean sand rather than silt or clay which comprise the bulk content of the rest of the samples.

Summary

This report documents the concentrations of methane in sediment, water, and sea ice in an area of the Beaufort Sea continental shelf offshore northern Alaska. Data were collected during field surveys conducted from 1990 to 1994. In addition to methane concentrations, information regarding methane oxidation rates, nutrients , salinity, and temperature of the water column is also tabulated. In general, more methane is present in the water when ice forms a seal over the water column than when ice is absent. Methane is also present in ice often in concentrations exceeding those in water. Fast ice forming in place over water depths less than about 10 m can contain methane concentrations an order of magnitude higher than that of the underlying water. Measurements of the carbon isotopic composition of methane and ice were initiated in 1994 as an attempt to define the source or sources of methane. These data represent the first ever collected is such a setting. The data thus far demonstrate a wide range of values from -31.6 to -83.4‰ indicating that there a may be complex variety of sources.

Acknowledgments

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Table 1. Methane concentrations (nM, nanomoles methane per liter seawater), methane carbon isotopic composition, and methane oxidation rates measured in seawater.

Station	Latitude N.	Longitude W.	Date	Sample depth (m)	Methane (nM)	Methane Isotopic Composition (ppt)	Methane Oxidation Rate (nM/day)	Comments
925010	7030.88	15008.31	5/1/92	3	**111.8**			5 km S. of Thetis I.
925114	7035.78	14953.67	5/1/92	3	**32.2**		0.045	Transect 1 15 m
925114	7035.78	14953.67	5/1/92	6	**33.1**		0.023	Transect 1 15 m
925114	7035.78	14953.67	5/1/92	9	**31.2**		0.012	Transect 1 15 m
925114	7035.78	14953.67	5/1/92	12	**40.8**		0.000	Transect 1 15 m
925120	7048.44	14950.16	5/1/92	3	**34.7**		0.042	Transect 1 20 m
925120	7048.44	14950.16	5/1/92	6	**33.7**		0.007	Transect 1 20 m
925120	7048.44	14950.16	5/1/92	11	**42.9**		0.257	Transect 1 20 m
925120	7048.44	14950.16	5/1/92	16	**84.6**		0.017	Transect 1 20 m
925120	7048.44	14950.16	5/1/92	21	**94.4**		0.104	Transect 1 20 m
925130	7100.53	14952.66	5/2/92	5	**23.1**		0.009	Transect 1 30 m
925130	7100.53	14952.66	5/2/92	10	**20.5**		0.001	Transect 1 30 m
925130	7100.53	14952.66	5/2/92	15	**20.2**		0.016	Transect 1 30 m
925130	7100.53	14952.66	5/2/92	20	**19.0**		0.000	Transect 1 30 m
925130	7100.53	14952.66	5/2/92	25	**19.4**		0.004	Transect 1 30 m
925130	7100.53	14952.66	5/2/92	30	**24.5**		0.049	Transect 1 30 m
925150	7108.96	14952.93	5/2/92	5	**27.5**		0.000	Transect 1 50 m
925150	7108.96	14952.93	5/2/92	13	**24.7**		0.007	Transect 1 50 m
925150	7108.96	14952.93	5/2/92	21	**25.5**		0.000	Transect 1 50 m
925150	7108.96	14952.93	5/2/92	29	**26.3**		0.124	Transect 1 50 m
925150	7108.96	14952.93	5/2/92	37	**10.7**		0.047	Transect 1 50 m
925150	7108.96	14952.93	5/2/92	45	**13.0**		0.048	Transect 1 50 m
925150	7108.96	14952.93	5/2/92	49	**25.0**		0.008	Transect 1 50 m
925188	7112.12	14954.82	5/2/92	3	**24.6**		0.000	Transect 1 88 m
925188	7112.12	14954.82	5/2/92	10	**25.5**		0.000	Transect 1 88 m
925188	7112.12	14954.82	5/2/92	20	**24.5**			Transect 1 88 m
925188	7112.12	14954.82	5/2/92	30	**25.3**		0.000	Transect 1 88 m
925188	7112.12	14954.82	5/2/92	40	**22.4**			Transect 1 88 m
925188	7112.12	14954.82	5/2/92	50	**12.4**		0.000	Transect 1 88 m
925188	7112.12	14954.82	5/2/92	60	**10.9**			Transect 1 88 m
925188	7112.12	14954.82	5/2/92	70	**15.8**		0.001	Transect 1 88 m
925188	7112.12	14954.82	5/2/92	80	**16.5**			Transect 1 88 m
925188	7112.12	14954.82	5/2/92	88	**17.1**		0.000	Transect 1 88 m
934001	7024.36	14831.65	4/12/93	0	**42.7**			West Dock, Prudhoe Bay
934002	7030.91	15006.07	4/13/93	0	**28.2**			1.5 km SE. Thetis Island
934003	7029.97	15003.72	4/13/93	0	**16.9**			3 km SE. Thetis Island
934004	7028.99	15001.44	4/13/93	0	**9.8**			7 km SE. of Thetis Island
934005	7030.73	14951.76	4/13/93	0	**24.2**			Saltwater Treatment Plant, Oliktok Pt.
934006	7031.97	14923.89	4/13/93	0	**12.2**			N. of Milne Point
934010	7030.15	15008.84	4/17/93	0	**174.5**		0.140	5 km S. of Thetis Island
934015	7238.88	15103.28	4/17/93	0	**5.8**			U.S. Navy Ice floe station
934018	7015.01	14818.29	4/19/93	0	**13.2**			Sagavanirktok River

Table 1. Methane concentrations (nM, nanomoles methane per liter seawater), methane carbon isotopic composition, and methane oxidation rates measured in seawater.

Station	Latitude N.	Longitude W.	Date	Sample depth (m)	Methane (nM)	Methane Isotopic Composition (ppt)	Methane Oxidation Rate (nM/day)	Comments
934019	7004.15	14459.90	4/18/93	0	**22.1**			Camden Bay wd=12.7m
934020	7006.75	14531.58	4/18/93	0	**14.6**			Mouth of Canning R. wd=12.7m
934022	7005.10	14530.45	4/18/93	0	**19.8**			N. of Canning R. wd=1.8m
934023	7018.54	14600.97	4/18/93	0	**3.1**			N. of Canning R. wd=28.5m
934024	7013.15	14700.82	4/18/93	0	**34.0**			Leffingwell Lagoon wd=5.6m
934026	7027.16	14700.82	4/18/93	0	**8.5**			Stefansson Sound wd=21.6m
934027	7035.14	14800.73	4/18/93	0	**22.8**			Mikkelsen Bay wd=6.6m
934029	7026.86	15015.26	4/18/93	0	**17.5**			Colville R. Delta wd=2.4m
934030	7035.21	15027.33	4/22/93	3	**34.1**		0.010	Colville R. Delta wd=9.5 m
934030	7035.21	15027.33	4/22/93	9	**33.6**		0.027	Colville R. Delta wd=9.5 m
934103	7032.21	14952.42	4/15/93	2.5	**16.7**		0.037	Transect 1 3 m Oliktok Point
934114	7038.05	14952.88	4/17/93	3	**12.3**		0.003	Transect 1 15 m Oliktok Point
934114	7038.05	14952.88	4/17/93	8	**11.2**		0.004	Transect 1 15 m Oliktok Point
934114	7038.05	14952.88	4/17/93	13.5	**10.5**		0.006	Transect 1 15 m Oliktok Point
934120	7046.83	14954.08	4/17/93	3	**24.4**		0.004	Transect 1 20 m Oliktok Point
934120	7046.83	14954.08	4/17/93	7	**26.0**		0.008	Transect 1 20 m Oliktok Point
934120	7046.83	14954.08	4/17/93	11	**21.8**		0.009	Transect 1 20 m Oliktok Point
934120	7046.83	14954.08	4/17/93	15	**20.5**		0.000	Transect 1 20 m Oliktok Point
934120	7046.83	14954.08	4/17/93	19	**26.3**		0.000	Transect 1 20 m Oliktok Point
934130	7103.16	14953.40	4/17/93	3	**18.8**		0.000	Transect 1 30 m Oliktok Point
934130	7103.16	14953.40	4/17/93	10	**21.1**		0.000	Transect 1 30 m Oliktok Point
934130	7103.16	14953.40	4/17/93	17	**21.3**		0.002	Transect 1 30 m Oliktok Point
934130	7103.16	14953.40	4/17/93	24	**14.9**		0.003	Transect 1 30 m Oliktok Point
934130	7103.16	14953.40	4/17/93	30	**15.4**		0.006	Transect 1 30 m Oliktok Point
934210	7035.09	15048.47	4/22/93	3	**45.3**		0.100	Transect 2 10 m Colville R.
934210	7035.09	15048.47	4/22/93	8	**52.0**			Transect 2 10 m Colville R.
934215	7041.08	15047.95	4/22/93	3	**22.8**		0.021	Transect 2 15 m Colville R.
934215	7041.08	15047.95	4/22/93	9	**26.0**		0.049	Transect 2 15 m Colville R.
934215	7041.08	15047.95	4/22/93	15	**9.9**		0.099	Transect 2 15 m Colville R.
934216	7057.84	15048.55	4/22/93	3	**22.5**		0.027	Transect 2 16 m near Weller Bank
934216	7057.84	15048.55	4/22/93	9	**24.7**		0.022	Transect 2 16 m near Weller Bank
934216	7057.84	15048.55	4/22/93	15	**26.8**		0.027	Transect 2 16 m near Weller Bank
934220	7050.91	15048.63	4/22/93	3	**23.6**		0.009	Transect 2 20 m Colville R.
934220	7050.91	15048.63	4/22/93	8	**24.6**		0.012	Transect 2 20 m Colville R.
934220	7050.91	15048.63	4/22/93	13	**20.6**		0.012	Transect 2 20 m Colville R.
934220	7050.91	15048.63	4/22/93	17	**24.1**		0.012	Transect 2 20 m Colville R.
934220	7050.91	15048.63	4/22/93	20	**18.3**		0.002	Transect 2 20 m Colville R.

Table 1. Methane concentrations (nM, nanomoles methane per liter seawater), methane carbon isotopic composition, and methane oxidation rates measured in seawater.

Station	Latitude N.	Longitude W.	Date	Sample depth (m)	Methane (nM)	Methane Isotopic Composition (ppt)	Methane Oxidation Rate (nM/day)	Comments
934240	7107.94	15049.41	4/22/93	3	**22.8**		0.007	Transect 2 40 m Colville R.
934240	7107.94	15049.41	4/22/93	9	**19.7**		0.008	Transect 2 40 m Colville R.
934240	7107.94	15049.41	4/22/93	15	**21.7**		0.013	Transect 2 40 m Colville R.
934240	7107.94	15049.41	4/22/93	21	**18.0**		0.009	Transect 2 40 m Colville R.
934240	7107.94	15049.41	4/22/93	27	**21.1**		0.046	Transect 2 40 m Colville R.
934240	7107.94	15049.41	4/22/93	33	**23.4**		0.042	Transect 2 40 m Colville R.
934240	7107.94	15049.41	4/22/93	38	**25.2**		0.038	Transect 2 40 m Colville R.
934503	7021.18	14756.93	4/18/93	0	**26.1**			Transect 5 03 m Endicott Dock
939001	7024.54	14831.47	9/13/93	1	**5.5**			West Dock, Prudhoe Bay
939003	7029.02	15008.71	9/13/93	1	**18.0**			3 km SE. Thetis Island
939010	7029.56	15008.86	9/13/93	1	**13.3**			5 km SE. Thetis Island
939018	7015.00	14818.30	9/14/93	0	**9.5**			Sagavanirktok River
939018	7015.00	14818.30	9/14/93	0	**9.7**			Sagavanirktok River
939018	7015.00	14818.30	9/14/93	0	**9.5**			Sagavanirktok River
939018	7015.00	14818.30	9/14/93	0	**13.5**			Sagavanirktok River
939103	7031.97	14952.98	9/9/93	0	**7.8**			Transect 1 3 m Oliktok Point
939114	7037.83	14953.84	9/9/93	0	**14.9**			Transect 1 14m Oliktok Point
939114	7037.83	14953.84	9/9/93	4	**18.6**			Transect 1 14m Oliktok Point
939114	7037.83	14953.84	9/9/93	8	**18.3**			Transect 1 14m Oliktok Point
939114	7037.83	14953.84	9/9/93	12	**19.4**			Transect 1 14m Oliktok Point
939120	7047.26	14952.35	9/10/93	0	**10.7**		nd	Transect 1 20 m Oliktok Point
939120	7047.26	14952.35	9/10/93	5	**10.0**		nd	Transect 1 20 m Oliktok Point
939120	7047.26	14952.35	9/10/93	10	**16.0**		nd	Transect 1 20 m Oliktok Point
939120	7047.26	14952.35	9/10/93	15	**18.2**		nd	Transect 1 20 m Oliktok Point
939120	7047.26	14952.35	9/10/93	19	**20.0**		nd	Transect 1 20 m Oliktok Point
939125	7049.87	15001.01	9/13/93	2	**12.9**			Transect 1 25 m Oliktok Point
939125	7049.87	15001.01	9/13/93	7	**12.8**			Transect 1 25 m Oliktok Point
939125	7049.87	15001.01	9/13/93	12	**13.2**			Transect 1 25 m Oliktok Point
939125	7049.87	15001.01	9/13/93	17	**13.0**			Transect 1 25 m Oliktok Point
939125	7049.87	15001.01	9/13/93	22	**13.6**			Transect 1 25 m Oliktok Point
939130	7103.13	14951.24	9/10/93	5	**5.4**		nd	Transect 1 30 m Oliktok Point
939130	7103.13	14951.24	9/10/93	10	**4.9**		nd	Transect 1 30 m Oliktok Point
939130	7103.13	14951.24	9/10/93	21	**5.1**		nd	Transect 1 30 m Oliktok Point
939130	7103.13	14951.24	9/10/93	25	**27.2**		nd	Transect 1 30 m Oliktok Point
939130	7103.13	14951.24	9/10/93	28	**44.4**		nd	Transect 1 30 m Oliktok Point
939140	7107.62	14952.42	9/12/93	0	**6.6**			Transect 1 40 m Oliktok Point
939140	7107.62	14952.42	9/12/93	6	**6.7**			Transect 1 40 m Oliktok Point
939140	7107.62	14952.42	9/12/93	12	**6.9**			Transect 1 40 m Oliktok Point
939140	7107.62	14952.42	9/12/93	18	**9.1**			Transect 1 40 m Oliktok Point
939140	7107.62	14952.42	9/12/93	24	**15.8**			Transect 1 40 m Oliktok Point
939140	7107.62	14952.42	9/12/93	30	**23.7**			Transect 1 40 m Oliktok Point
939140	7107.62	14952.42	9/12/93	36	**23.1**			Transect 1 40 m Oliktok Point
939140	7107.62	14952.42	9/12/93	42	**28.0**			Transect 1 40 m Oliktok Point

Table 1. Methane concentrations (nM, nanomoles methane per liter seawater), methane carbon isotopic composition, and methane oxidation rates measured in seawater.

Station	Latitude N.	Longitude W.	Date	Sample depth (m)	Methane (nM)	Methane Isotopic Composition (ppt)	Methane Oxidation Rate (nM/day)	Comments
939210	7035.03	15049.67	9/13/93	0	**18.8**			Transect 2 10 m Colville R.
939210	7035.03	15049.67	9/13/93	3	**26.6**			Transect 2 10 m Colville R.
939210	7035.03	15049.67	9/13/93	6	**28.0**			Transect 2 10 m Colville R.
939212	7050.03	15041.56	9/11/93	0	**6.4**			Transect 2 12 m Weller Bank
939212	7050.03	15041.56	9/11/93	3	**6.6**			Transect 2 12 m Weller Bank
939212	7050.03	15041.56	9/11/93	6	**9.7**			Transect 2 12 m Weller Bank
939212	7050.03	15041.56	9/11/93	9	**11.2**			Transect 2 12 m Weller Bank
939215	7041.12	15048.75	9/11/93	1	**14.1**			Transect 2 15 m Colville R.
939215	7041.12	15048.75	9/11/93	5	**14.9**			Transect 2 15 m Colville R.
939215	7041.12	15048.75	9/11/93	9	**14.5**			Transect 2 15 m Colville R.
939215	7041.12	15048.75	9/11/93	13	**14.2**			Transect 2 15 m Colville R.
939220	7051.01	15048.91	9/11/93	1	**8.1**			Transect 2 20 m Colville R.
939220	7051.01	15048.91	9/11/93	5	**8.3**			Transect 2 20 m Colville R.
939220	7051.01	15048.91	9/11/93	10	**8.6**			Transect 2 20 m Colville R.
939220	7051.01	15048.91	9/11/93	15	**10.0**			Transect 2 20 m Colville R.
939240	7108.15	15048.14	9/11/93	1	**5.9**			Transect 2 38 m Colville R.
939240	7108.15	15048.14	9/11/93	11	**6.0**			Transect 2 38 m Colville R.
939240	7108.15	15048.14	9/11/93	16	**20.2**			Transect 2 38 m Colville R.
939240	7108.15	15048.14	9/11/93	21	**20.7**			Transect 2 38 m Colville R.
939240	7108.15	15048.14	9/11/93	26	**20.2**			Transect 2 38 m Colville R.
939240	7108.15	15048.14	9/11/93	31	**21.4**			Transect 2 38 m Colville R.
939240	7108.15	15048.14	9/11/93	36	**19.7**			Transect 2 38 m Colville R.
939402	7027.47	14850.81	9/13/93	0	**7.0**			Transect 4 3 m Colville R.
939420	7037.03	14846.09	9/9/93	0	**8.8**			Transect 4 20 m Colville R.
939420	7037.03	14846.09	9/9/93	4	**10.3**			Transect 4 20 m Colville R.
939420	7037.03	14846.09	9/9/93	7	**13.5**			Transect 4 20 m Colville R.
939420	7037.03	14846.09	9/9/93	12	**15.7**			Transect 4 20 m Colville R.
939420	7037.03	14846.09	9/9/93	16	**8.8**			Transect 4 20 m Colville R.
944010	7029.97	15009.03	4/24/94	2.5	**275.0**	**-71.3**		5 km S. of Thetis Island
944114	7037.90	14953.24	4/21/94	3	**18.5**			Transect 1 13 m Oliktok Point
944114	7037.90	14953.24	4/21/94	8	**18.1**	**-53.7**		Transect 1 13 m Oliktok Point
944114	7037.90	14953.24	4/21/94	12	**17.9**	**-36.1**		Transect 1 13 m Oliktok Point
944120	7046.86	14952.57	4/21/94	3	**15.3**	**-60.5**		Transect 1 20 m Oliktok Point
944120	7046.86	14952.57	4/21/94	8	**26.3**	**-58.5**		Transect 1 20 m Oliktok Point
944120	7046.86	14952.57	4/21/94	13	**24.7**	**-64.9**		Transect 1 20 m Oliktok Point
944120	7046.86	14952.57	4/21/94	18	**28.4**	**-52.3**		Transect 1 20 m Oliktok Point
944150	7109.15	14952.19	4/21/94	3	**24.6**	**-59.6**		Transect 1 50 m Oliktok Point
944150	7109.15	14952.19	4/21/94	12	**26.0**			Transect 1 50 m Oliktok Point
944150	7109.15	14952.19	4/21/94	25	**25.5**			Transect 1 50 m Oliktok Point
944150	7109.15	14952.19	4/21/94	37	**20.4**			Transect 1 50 m Oliktok Point
944150	7109.15	14952.19	4/21/94	48	**12.6**			Transect 1 50 m Oliktok Point
944305	7051.98	15212.12	4/26/94	3	**24.0**	**-46.4**		Transect 3 6 m Cape Halkett

Table 1. Methane concentrations (nM, nanomoles methane per liter seawater), methane carbon isotopic composition, and methane oxidation rates measured in seawater.

Station	Latitude N.	Lougitude W.	Date	Sample depth (m)	Methane (nM)	Methaue Isotopic Compositiou (ppt)	Methane Oxidation Rate (nM/day)	Commeuts
944320	7105.00	15212.01	4/26/94	3	**22.6**			Transect 3 16 m Cape Halkett
944320	7105.00	15212.01	4/26/94	7	**15.2**	**-54.7**		Transect 3 16 m Cape Halkett
944320	7105.00	15212.01	4/26/94	11	**15.9**	**-43.2**		Transect 3 16 m Cape Halkett
944320	7105.00	15212.01	4/26/94	15	**11.2**	**-39.7**		Transect 3 16 m Cape Halkett
944350	7119.01	15212.43	4/26/94	3	**17.7**	**-55.8**		Transect 3 57 m Cape Halkett
944350	7119.01	15212.43	4/26/94	12	**16.9**			Transect 3 57 m Cape Halkett
944350	7119.01	15212.43	4/26/94	25	**17.6**			Transect 3 57 m Cape Halkett
944350	7119.01	15212.43	4/26/94	35	**19.2**	**-56.5**		Transect 3 57 m Cape Halkett
944350	7119.01	15212.43	4/26/94	45	**13.9**			Transect 3 57 m Cape Halkett
944350	7119.01	15212.43	4/26/94	56	**18.7**	**-33.5**		Transect 3 57 m Cape Halkett
944502	7021.46	14757.63	4/23/94	2	**168.0**	**-80.5**		Transect 5 02 m Endicott
944503	7021.24	14757.09	4/19/94	3	**103.0**	**-73.0**		Transect 5 03 m Endicott dock
944505	7022.96	14756.64	4/20/94	3	**59.1**	**-65.3**		Transect 5 06 m Enidcott
944520	7032.01	14756.96	4/20/94	3	**11.3**	**-50.9**		Transect 5 20 m Endicott
944520	7032.01	14756.96	4/20/94	8	**13.9**	**-48.4**		Transect 5 20 m Endicott
944520	7032.01	14756.96	4/20/94	13	**15.8**			Transect 5 20 m Endicott
944520	7032.01	14756.96	4/20/94	18	**30.9**	**-53.6**		Transect 5 20 m Endicott
944550	7055.98	14757.00	4/20/94	3	**11.1**			Transect 5 46 m Enidicott
944550	7055.98	14757.00	4/20/94	12	**10.3**			Transect 5 46 m Enidicott
944550	7055.98	14757.00	4/20/94	25	**18.1**			Transect 5 46 m Enidicott
944550	7055.98	14757.00	4/20/94	35	**19.9**			Transect 5 46 m Enidicott
944550	7055.98	14757.00	4/20/94	45	**27.7**	**-47.1**		Transect 5 46 m Enidicott
944605	7015.02	14700.02	4/27/94	3	**37.8**	**-69.2**		Transect 6 05 m Mikkelsen Bay
944620	7123.02	14800.71	4/27/94	0	**12.2**			Transect 6 19 m Mikkelsen Bay
944620	7123.02	14800.71	4/27/94	3	**12.4**	**-50.1**		Transect 6 19 m Mikkelsen Bay
944620	7123.02	14800.71	4/27/94	8	**11.6**	**-53.3**		Transect 6 19 m Mikkelsen Bay
944620	7123.02	14800.71	4/27/94	13	**16.0**	**-52.8**		Transect 6 19 m Mikkelsen Bay
944620	7123.02	14800.71	4/27/94	18	**22.1**	**-58.3**		Transect 6 19 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	3	**10.1**	**-51.6**		Transect 6 49 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	12	**10.9**			Transect 6 49 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	20	**10.2**			Transect 6 49 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	30	**28.3**	**-56.4**		Transect 6 49 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	40	**26.7**			Transect 6 49 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	48	**21.8**	**-46.7**		Transect 6 49 m Mikkelsen Bay
948002	7030.95	15006.14	8/25/94	1	**8.8**	**-57.1**		1.5 km SE of Thetis Island
948002	7030.95	15006.14	8/25/94	3	**9.3**	**-62.1**		1.5 km SE of Thetis Island
948010	7030.96	15008.50	8/25/94	1	**10.2**			5 km S. of Thetis Island
948010	7030.96	15008.50	8/25/94	3	**10.5**	**-60.9**		5 km S. of Thetis Island
948103	70 32.21	14952.30	8/25/94	1	**13.9**	**-60.4**		Transect 1 03m Oliktok Point
948114	7037.89	14950.30	8/25/94	1	**11.6**	**-62.2**		Transect 1 14m Oliktok Point
948114	7037.89	14950.30	8/25/94	6	**14.3**			Transect 1 14m Oliktok Point
948114	7037.89	14950.30	8/25/94	12	**56.4**	**-31.1**		Transect 1 14m Oliktok Point

Table 1. Methane concentrations (nM, nanomoles methane per liter seawater), methane carbon isotopic composition, and methane oxidation rates measured in seawater.

Station	Latitude N.	Longitude W.	Date	Sample depth (m)	Methane (nM)	Methane Isotopic Composition (ppt)	Methane Oxidation Rate (nM/day)	Comments
948120	7046.93	14953.54	8/25/94	1	**7.8**	**-50.8**		Transect 1 20m Oliktok Point
948120	7046.93	14953.54	8/25/94	8	**9.3**	**-49.8**		Transect 1 20m Oliktok Point
948120	7046.93	14953.54	8/25/94	12	**13.5**	**-54.0**		Transect 1 20m Oliktok Point
948120	7046.93	14953.54	8/25/94	18	**148.6**	**-46.4**		Transect 1 20m Oliktok Point
948130	7103.09	14953.44	8/26/94	1	**5.4**	**-35.6**		Transect 1 30m Oliktok Point
948130	7103.09	14953.44	8/26/94	5	**4.8**	**-41.4**		Transect 1 30m Oliktok Point
948130	7103.09	14953.44	8/26/94	10	**6.1**			Transect 1 30m Oliktok Point
948130	7103.09	14953.44	8/26/94	14	**9.2**	**-53.0**		Transect 1 30m Oliktok Point
948130	7103.09	14953.44	8/26/94	18	**7.6**	**-52.0**		Transect 1 30m Oliktok Point
948130	7103.09	14953.44	8/26/94	24	**8.2**	**-54.1**		Transect 1 30m Oliktok Point
948130	7103.09	14953.44	8/26/94	29	**7.6**	**-51.7**		Transect 1 30m Oliktok Point
948150	7109.99	14954.51	8/26/94	1	**5.4**	**-43.4**		Transect 1 54m Oliktok Point
948150	7109.99	14954.51	8/26/94	10	**6.4**	**-49.0**		Transect 1 54m Oliktok Point
948150	7109.99	14954.51	8/26/94	20	**6.8**	**-48.0**		Transect 1 54m Oliktok Point
948150	7109.99	14954.51	8/26/94	25	**6.6**	**-46.9**		Transect 1 54m Oliktok Point
948150	7109.99	14954.51	8/26/94	30	**7.2**	**-52.4**		Transect 1 54m Oliktok Point
948150	7109.99	14954.51	8/26/94	40	**8.1**	**-53.4**		Transect 1 54m Oliktok Point
948150	7109.99	14954.51	8/26/94	50	**13.1**	**-50.5**		Transect 1 54m Oliktok Point
948500	7021.32	14757.18	8/22/94	3	**6.2**	**-49.7**		Endicott effluent site
948502	7021.47	14757.36	8/22/94	3	**13.3**	**-40.6**		Transect 5 02 m Enidcott
948503	7021.24	14757.11	8/22/94	3	**6.2**	**-47.5**		Endicott Dock
948505	7023.01	14756.95	8/22/94	1	**10.0**	**-46.7**		Transect 5 06 m Enidcott
948505	7023.01	14756.95	8/22/94	4	**9.0**	**-51.5**		Transect 5 06 m Enidcott
948520	7032.15	14756.59	8/23/94	1	**11.2**	**-51.8**		Transect 5 20 m Endicott
948520	7032.15	14756.59	8/23/94	6	**17.4**	**-48.5**		Transect 5 20 m Endicott
948520	7032.15	14756.59	8/23/94	9	**27.9**	**-41.9**		Transect 5 20 m Endicott
948520	7032.15	14756.59	8/23/94	12	**34.9**	**-38.9**		Transect 5 20 m Endicott
948520	7032.15	14756.59	8/23/94	17	**36.4**	**-36.0**		Transect 5 20 m Endicott
948545	7055.89	14756.63	8/23/94	0	**8.4**	**-50.1**		Transect 5 45 m Enidicott
948545	7055.89	14756.63	8/23/94	6	**10.1**	**-48.5**		Transect 5 45 m Enidicott
948545	7055.89	14756.63	8/23/94	11	**11.6**	**-54.2**		Transect 5 45 m Enidicott
948545	7055.89	14756.63	8/23/94	16	**10.6**	**-51.6**		Transect 5 45 m Enidicott
948545	7055.89	14756.63	8/23/94	27	**17.2**	**-45.0**		Transect 5 45 m Enidicott
948545	7055.89	14756.63	8/23/94	35	**21.0**	**-50.8**		Transect 5 45 m Enidicott
948545	7055.89	14756.63	8/23/94	43	**20.0**	**-51.9**		Transect 5 45 m Enidicott
948605	7015.06	14700.10	8/24/94	1	**8.5**	**-54.1**		Transect 6 05m Mikkelsen Bay
948605	7015.06	14700.10	8/24/94	3	**8.1**	**-54.3**		Transect 6 05m Mikkelsen Bay
948620	7022.99	14700.06	8/24/94	0	**9.3**			Transect 6 20m Mikkelsen Bay
948620	7022.99	14700.06	8/24/94	7	**11.2**	**-46.9**		Transect 6 20m Mikkelsen Bay
948620	7022.99	14700.06	8/24/94	13	**36.4**	**-36.9**		Transect 6 20m Mikkelsen Bay
948620	7022.99	14700.06	8/24/94	18	**40.8**	**-42.1**		Transect 6 20m Mikkelsen Bay

Table 2. Seawater nutrient concentrations (mM, millimoles nutrient per liter) measured in May, 1992.

Station	Depth	PO4	Si	NO3	NO2	NH4
	(m)	(mM)	(mM)	(mM)	(mM)	(mM)
925120	3	1.46	12.77	2.95	0.05	1.68
925120	6	0.97	14.43	2.98	0.04	0.58
925120	11	0.99	12.30	3.24	0.05	2.22
925120	16	1.03	15.10	3.46	0.08	0.85
925120	21	1.12	18.66	3.97	0.31	1.21
925130	5	0.94	9.64	2.02	0.07	1.26
925130	10	1.04	11.63	3.76	0.06	1.15
925130	15	1.77	12.51	3.92	0.08	2.09
925130	20	1.08	16.27	3.35	0.08	1.34
925130	25	0.97	13.58	3.48	0.09	0.57
925150	5	0.92	10.58	2.31	0.02	0.68
925150	13	0.96	9.92	2.40	0.02	0.81
925150	21	0.94	13.21	2.28	0.02	0.96
925150	37	1.36	22.56	7.73	0.01	1.98
925150	45	1.40	22.29	7.86	0.00	1.39
925150	49	0.95	12.05	2.22	0.03	0.68
925188	3	0.61	4.75	1.09	0.00	1.70
925188	10	0.94	8.01	1.81	0.01	1.81
925188	20	1.12	7.99	1.71	0.00	1.23
925188	30	0.99	10.07	2.45	0.00	1.58
925188	40	1.35	15.01	5.52	0.01	4.83
925188	50	1.45	23.10	8.18	0.01	1.60
925188	60	1.43	23.88	10.35	0.00	1.14
925188	70	1.61	29.58	12.22	0.01	1.26
925188	80	1.67	31.54	12.42	0.01	1.70
925188	88	1.80	21.68	12.31	0.05	4.87

Table 3. Methane concentrations (nM, nanomoles methane per liter melted ice), and methane carbon isotopic composition in ice.

Station	Latitude N.	Longitude W.	Date	Core interval (cm)	Methane (nM)	Carbon Isotopic Composition (ppt)	Carbon Isotopic Composition (ppt) duplicate	Description
925010	7030.88	15008.81	5/1/92	80-90	**1146.17**			5 km S. of Thetis I.
934001	7024.36	14831.65	4/12/93	0-12	**9.19**			West Dock, Prudhoe Bay
934001	7024.36	14831.65	4/12/93	30-40	**7.65**			West Dock, Prudhoe Bay
934001	7024.36	14831.65	4/12/93	40-50	**17.10**			West Dock, Prudhoe Bay
934001	7024.36	14831.65	4/12/93	75-85	**25.20**			West Dock, Prudhoe Bay
934001	7024.36	14831.65	4/12/93	85-97	**16.58**			West Dock, Prudhoe Bay
934001	7024.36	14831.65	4/12/93	115-127	**5.16**			West Dock, Prudhoe Bay
934001	7024.36	14831.65	4/12/93	162-172	**9.15**			West Dock, Prudhoe Bay
934002	7030.91	15006.07	4/13/93	20-30	**925.80**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/13/93	55-65	**14.43**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/13/93	75-85	**6.71**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	0-10	**476.54**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	10_20	**449.87**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	20-30	**728.48**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	30-40	**1265.87**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	40-47	**302.16**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	47-59	**69.60**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	59-70	**8.08**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	70-80	**12.30**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	80-90	**9.17**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	90-100	**4.38**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	100-110	**6.88**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	110-120	**4.57**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	120-130	**5.36**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	130-140	**7.13**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	162-173	**5.03**			1.5 km SE. of Thetis I.
934002	7030.91	15006.07	4/14/93	150-162	**4.92**			1.5 km SE. of Thetis I.
934003	7029.97	15003.72	4/13/93	20-30	**130.54**			3 km SE. of Thetis I.
934003	7029.97	15003.72	4/13/93	40-50	**22.98**			3 km SE. of Thetis I.
934003	7029.97	15003.72	4/13/93	75-85	**7.95**			3 km SE. of Thetis I.
934004	7028.99	15001.44	4/13/93	20-30	**64.80**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/13/93	40-50	**210.65**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/13/93	77-87	**6.63**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	0-8	**25.06**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	08_20	**23.42**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	20-30	**101.80**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	30-40	**182.70**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	40-49	**59.33**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	49-59	**6.37**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	59-69	**6.34**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	69-80	**1.05**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	80-90	**0.00**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	90-100	**5.64**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	100-110	**5.47**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	123-134	**0.00**			7 km SE. of Thetis I.
934004	7028.99	15001.44	4/14/93	145-156	**8.38**			7 km SE. of Thetis I.
934005	7030.73	14951.76	4/13/93	20-30	**118.10**			Saltwater Treatment Plant, Oliktok Pt
934005	7030.73	14951.76	4/13/93	35-45	**174.90**			Saltwater Treatment Plant, Oliktok Pt
934005	7030.73	14951.76	4/13/93	80-90	**34.93**			Saltwater Treatment Plant, Oliktok Pt
934006	7031.97	14923.89	4/13/93	0-10	**7.43**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	10_20	**1.81**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	20-30	**6.17**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	30-40	**14.27**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	40-50	**18.28**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	50-60	**5.95**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	60-70	**5.50**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	70-80	**10.57**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	80-90	**8.71**			N. of Milne Pt.

Table 3. Methane concentrations (nM, nanomoles methane per liter melted ice), and methane carbon isotopic composition in ice.

Station	Latitude N.	Longitude W.	Date	Core interval (cm)	Methane (nM)	Carbon Isotopic Composition (ppt)	Carbon Isotopic Composition (ppt) duplicate	Description
934006	7031.97	14923.89	4/13/93	90-100	**8.61**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	100-110	**8.94**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	110-120	**15.37**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	120-130	**15.34**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	130-140	**39.61**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	140-150	**16.11**			N. of Milne Pt.
934006	7031.97	14923.89	4/13/93	40-50	**17.86**			N. of Milne Pt. (separate core)
934009	7012.92	14829.07	4/15/93	0-10	**6.32**			Lake Colleen
934009	7012.92	14829.07	4/15/93	10_20	**2.88**			Lake Colleen
934009	7012.92	14829.07	4/15/93	20-30	**2.54**			Lake Colleen
934009	7012.92	14829.07	4/15/93	30-40	**5.31**			Lake Colleen
934009	7012.92	14829.07	4/15/93	40-50	**8.92**			Lake Colleen
934009	7012.92	14829.07	4/15/93	50-59	**35.82**			Lake Colleen
934010	7030.88	15008.81	4/17/93	0-10	**231.39**			5 km S. of Thetis I.
934010	7030.88	15008.81	4/17/93	20-30	**602.65**			5 km S. of Thetis I.
934010	7030.88	15008.81	4/17/93	60-70	**11.85**			5 km S. of Thetis I.
934010	7030.88	15008.81	4/17/93	130-140	**14.41**			5 km S. of Thetis I.
934016	7019.43	14752.27	4/17/93	10_20	**32.71**			Endicott N. of Stateline I., ice fzn to bottom
934016	7019.43	14752.27	4/17/93	30-40	**185.89**			Endicott N. of Stateline I., ice fzn to bottom
934016	7019.43	14752.27	4/17/93	80-90	**161.62**			Endicott N. of Stateline I.. ice fzn to bottom
934016	7019.43	14752.27	4/17/93	120-130	**51.43**			Endicott N. of Stateline I., ice fzn to bottom
934016	7019.43	14752.27	4/17/93	150-160	**118.48**			Endicott N. of Stateline I., ice fzn to bottom
934018	7015.01	14818.29	4/17/93	0-10	**26.86**			Sagavanirktok River core 1
934018	7015.01	14818.29	4/17/93	30-40	**16.09**			Sagavanirktok River core 1
934018	7015.01	14818.29	4/17/93	60-70	**17.40**			Sagavanirktok River core 1
934018	7015.01	14818.29	4/17/93	90-100	**16.97**			Sagavanirktok River core 1
934018	7015.01	14818.29	4/17/93	70-80	**14.13**			Sagavanirktok River core 2
934018	7015.01	14818.29	4/17/93	80-90	**16.27**			Sagavanirktok River core 2
934018	7015.01	14818.29	4/17/93	90-100	**18.70**			Sagavanirktok River core 2
934018	7015.01	14818.29	4/17/93	113-123	**68.86**			Sagavanirktok River core 2
934019	7004.15	14459.90	4/18/93	0-10	**23.69**			Camden Bay wd = 12.7 m
934019	7004.15	14459.90	4/18/93	20-30	**22.31**			Camden Bay wd = 12.7 m
934019	7004.15	14459.90	4/18/93	30-40	**28.44**			Camden Bay wd = 12.7 m
934019	7004.15	14459.90	4/18/93	90-100	**27.07**			Camden Bay wd = 12.7 m
934019	7004.15	14459.90	4/18/93	120-130	**28.73**			Camden Bay wd = 12.7 m
934020	7006.75	14531.58	4/18/93	0-10	**29.91**			Mouth of Canning R. wd = 12.7 m
934020	7006.75	14531.58	4/18/93	18-28	**33.32**			Mouth of Canning R. wd = 12.7 m
934020	7006.75	14531.58	4/18/93	40-50	**22.48**			Mouth of Canning R. wd = 12.7 m
934020	7006.75	14531.58	4/18/93	70-80	**16.37**			Mouth of Canning R. wd = 12.7 m
934020	7006.75	14531.58	4/18/93	115-125	**12.86**			Mouth of Canning R. wd = 12.7 m
934021	7004.75	14530.87	4/18/93	15-25	**49.99**			Mouth of Canning R. wd = ? hit sediment
934021	7004.75	14530.87	4/18/93	50-60	**31.20**			Mouth of Canning R. wd = ? hit sediment
934021	7004.75	14530.87	4/18/93	80-90	**44.84**			Mouth of Canning R. wd = ? hit sediment
934021	7005.10	14530.45	4/18/93	15-25	**26.29**			N. of Canning R. wd = 1.8 m
934021	7005.10	14530.45	4/18/93	40-50	**31.79**			N. of Canning R. wd = 1.8 m
934021	7005.10	14530.45	4/18/93	50-60 air leak				N. of Canning R. wd = 1.8 m
934021	7005.10	14530.45	4/18/93	80-90	**6.43**			N. of Canning R. wd = 1.8 m
934021	7005.10	14530.45	4/18/93	110-120	**21.22**			N. of Canning R. wd = 1.8 m
934023	7018.54	14600.97	4/18/93	0-10	**7.39**			N. of Canning R. wd = 28.5 m
934023	7018.54	14600.97	4/18/93	20-30	**8.77**			N. of Canning R. wd = 28.5 m
934023	7018.54	14600.97	4/18/93	50-60	**9.09**			N. of Canning R. wd = 28.5 m
934023	7018.54	14600.97	4/18/93	80-90	**9.19**			N. of Canning R. wd = 28.5 m
934023	7018.54	14600.97	4/18/93	200-210 air leak				N. of Canning R. wd = 28.5 m
934024	7013.15	14700.82	4/18/93	0-10	**16.08**			Leffingwell Lagoon wd = 5.6 m
934024	7013.15	14700.82	4/18/93	20-30	**44.39**			Leffingwell Lagoon wd = 5.6 m

Table 3. Methane concentrations (nM, nanomoles methane per liter melted ice), and methane carbon isotopic composition in ice.

Station	Latitude N.	Longitude W.	Date	Core interval (cm)	Methane (nM)	Carbon Isotopic Composition (ppt)	Carbon Isotopic Composition (ppt) duplicate	Description
934024	7013.15	14700.82	4/18/93	60-70	**20.18**			Leffingwell Lagoon wd = 5.6 m
934024	7013.15	14700.82	4/18/93	140-150	**8.33**			Leffingwell Lagoon wd = 5.6 m
934025	7027.16	14700.82	4/18/93	10_20	**7.02**			N. of Leffingwell Lagoon wd about 20 m
934025	7027.16	14700.82	4/18/93	80-90	**14.09**			N. of Leffingwell Lagoon wd about 20 m
934025	7027.16	14700.82	4/18/93	150-160	**12.52**			N. of Leffingwell Lagoon wd about 20 m
934026	7035.14	14800.73	4/18/93	20-30	**10.17**			Stefansson Sound wd = 21.6 m
934026	7035.14	14800.73	4/18/93	80-90	**5.67**			Stefansson Sound wd = 21.6 m
934026	7035.14	14800.73	4/18/93	110-120	**5.18**			Stefansson Sound wd = 21.6 m
934027	7024.77	14759.75	4/18/93	0-10	**24.56**			Mikkelsen Bay wd = 6.6 m
934027	7024.77	14759.75	4/18/93	20-30	**17.28**			Mikkelsen Bay wd = 6.6 m
934027	7024.77	14759.75	4/18/93	60-70	**24.44**			Mikkelsen Bay wd = 6.6 m
934027	7024.77	14759.75	4/18/93	140-150	**7.33**			Mikkelsen Bay wd = 6.6 m
934028	7029.63	15022.88	4/18/93	0-10	**8.31**			Colville R. Delta, hit sediment
934028	7029.63	15022.88	4/18/93	20-30	**111.31**			Colville R. Delta, hit sediment
934028	7029.63	15022.88	4/18/93	60-70	**21.44**			Colville R. Delta, hit sediment
934028	7029.63	15022.88	4/18/93	80-90	**185.92**			Colville R. Delta, hit sediment
934028	7029.63	15022.88	4/18/93	92-102	**16.05**			Colville R. Delta, hit sediment
934029	7026.86	15015.26	4/18/93	0-10	**15.52**			Colville R. Delta, wd = 2.4m
934029	7026.86	15015.26	4/18/93	20-30	**12.83**			Colville R. Delta, wd = 2.4m
934029	7026.86	15015.26	4/18/93	50-60	**6.80**			Colville R. Delta, wd = 2.4m
934029	7026.86	15015.26	4/18/93	100-110	**8.32**			Colville R. Delta, wd = 2.4m
934029	7026.86	15015.26	4/18/93	130-140	**7.72**			Colville R. Delta, wd = 2.4m
934029	7026.86	15015.26	4/18/93	165-175	**4.19**			Colville R. Delta, wd = 2.4m
934030	7035.21	15027.33	4/22/93	10_20	**30.74**			Colville Delta 9.5 m
934030	7035.21	15027.33	4/22/93	20-30	**18.14**			Colville Delta 9.5 m
934030	7035.21	15027.33	4/22/93	40-50	**17.67**			Colville Delta 9.5 m
934030	7035.21	15027.33	4/22/93	70-80	**23.11**			Colville Delta 9.5 m
934030	7035.21	15027.33	4/22/93	140-150	**11.08**			Colville Delta 9.5 m
934103	7032.21	14952.42	4/15/93	0-10	**87.17**			Transect 1 03 m
934103	7032.21	14952.42	4/15/93	20-30	**80.83**			Transect 1 03 m
934103	7032.21	14952.42	4/15/93	60-70	**20.85**			Transect 1 03 m
934103	7032.21	14952.42	4/15/93	130-140	**8.45**			Transect 1 03 m
934114	7038.05	14952.88	4/17/93	18-28	**12.42**			Transect 1 14 m
934114	7038.05	14952.88	4/17/93	130-140	**7.78**			Transect 1 14 m
934120	7046.83	14954.08	4/17/93	0-10	**8.54**			Transect 1 20 m
934120	7046.83	14954.08	4/17/93	25-35	**14.01**			Transect 1 20 m
934120	7046.83	14954.08	4/17/93	50-60	**8.27**			Transect 1 20 m
934120	7046.83	14954.08	4/17/93	75-85	**12.56**			Transect 1 20 m
934120	7046.83	14954.08	4/17/93	110-120	**10.08**			Transect 1 20 m
934120	7046.83	14954.08	4/17/93	150-160	**10.67**			Transect 1 20 m
934130	7103.16	14953.40	4/17/93	10_20	**13.97**			Transect 1 30 m
934130	7103.16	14953.40	4/17/93	30-40	**10.31**			Transect 1 30 m
934130	7103.16	14953.40	4/17/93	60-70	**10.57**			Transect 1 30 m
934130	7103.16	14953.40	4/17/93	90-100	**8.37**			Transect 1 30 m
934130	7103.16	14953.40	4/17/93	115-125	**8.78**			Transect 1 30 m
934210	7035.09	15048.47	4/22/93	0-10	**36.41**			Transect 2 10 m
934210	7035.09	15048.47	4/22/93	20-30	**17.78**			Transect 2 10 m
934210	7035.09	15048.47	4/22/93	40-50	**25.86**			Transect 2 10 m
934210	7035.09	15048.47	4/22/93	70-80	**13.19**			Transect 2 10 m
934210	7035.09	15048.47	4/22/93	140-150	**8.37**			Transect 2 10 m
934215	7041.08	15047.95	4/22/93	20-30	**12.47**			Transect 2 15 m
934215	7041.08	15047.95	4/22/93	60-70	**13.77**			Transect 2 15 m
934215	7041.08	15047.95	4/22/93	140-150	**7.76**			Transect 2 15 m

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Station	Latitude N.	Longitude W.	Date	Core interval (cm)	Methane (nM)	Carbon Isotopic Composition (ppt)	Carbon Isotopic Composition (ppt) dnplicate	Description
934216	7057.84	15048.55	4/22/93	20-30	**11.27**			Transect 2 12 m, Weller Bank
934216	7057.84	15048.55	4/22/93	70-80	**8.43**			Transect 2 12 m, Weller Bank
934216	7057.84	15048.55	4/22/93	140-150	**6.30**			Transect 2 12 m, Weller Bank
934220	7050.91	15048.63	4/22/93	20-30	**11.57**			Transect 2 20 m
934220	7050.91	15048.63	4/22/93	60-70	**10.08**			Transect 2 20 m
934220	7050.91	15048.63	4/22/93	140-150	**7.09**			Transect 2 20 m
934240	7107.94	15049.41	4/22/93	20-30	**13.43**			Transect 2 40 m
934240	7107.94	15049.41	4/22/93	30-40	**11.58**			Transect 2 40 m
934503	7021.18	14756.93	4/18/93	10_20	**78.61**			Transect 5 03 m Endicott Dock
934503	7021.18	14756.93	4/18/93	30-40	**84.83**			Transect 5 03 m Endicott Dock
934503	7021.18	14756.93	4/18/93	60-70	**239.74**			Transect 5 03 m Endicott Dock
934503	7021.18	14756.93	4/18/93	90-100	**285.93**			Transect 5 03 m Endicott Dock
934503	7021.18	14756.93	4/18/93	140-150	**27.52**			Transect 5 03 m Endicott Dock
934503	7021.18	14756.93	4/18/93	160-170	**20.95**			Transect 5 03 m Endicott Dock
944001	7924.62	14831.60	4/25/94	0-10	**15.22**			West Dock, Prudhoe Bay
944001	7924.62	14831.60	4/25/94	20-30	**11.64**			West Dock, Prudhoe Bay
944001	7924.62	14831.60	4/25/94	40-50	**14.47**			West Dock, Prudhoe Bay
944001	7924.62	14831.60	4/25/94	60-70	**12.37**			West Dock, Prudhoe Bay
944001	7924.62	14831.60	4/25/94	80-90	**53.45**			West Dock, Prudhoe Bay
944001	7924.62	14831.60	4/25/94	100-110	**9.29**			West Dock, Prudhoe Bay
944001	7924.62	14831.60	4/25/94	120-130	**10.31**			West Dock, Prudhoe Bay
944001	7924.62	14831.60	4/25/94	140-150	**9.66**			West Dock, Prudhoe Bay
944001	7924.62	14831.60	4/25/94	160-170	**7.09**			West Dock, Prudhoe Bay
944001	7924.62	14831.60	4/25/94	180-190	**11.40**			West Dock, Prudhoe Bay
944010	7019.97	15009.03	4/24/94	0-10	**143.07**	-79.675	-81.119	5 km S. of Thetis I.
944010	7019.97	15009.03	4/24/94	20-30	**341.53**	-79.039	-79.194	5 km S. of Thetis I.
944010	7019.97	15009.03	4/24/94	40-50	**15.21**			5 km S. of Thetis I.
944010	7019.97	15009.03	4/24/94	60-70	**44.64**			5 km S. of Thetis I.
944010	7019.97	15009.03	4/24/94	80-90	**10.69**			5 km S. of Thetis I.
944010	7019.97	15009.03	4/24/94	100-110	**15.09**			5 km S. of Thetis I.
944010	7019.97	15009.03	4/24/94	120-130	**11.25**			5 km S. of Thetis I.
944010	7019.97	15009.03	4/24/94	140-150	**27.34**			5 km S. of Thetis I.
944010	7019.97	15009.03	4/24/94	160-170	**22.79**			5 km S. of Thetis I.
944036	7003.16	14512.30	4/25/94	0-10	**12.39**			Camden Bay 6.5m
944036	7003.16	14512.30	4/25/94	20-30	**6.54**			Camden Bay 6.5m
944036	7003.16	14512.30	4/25/94	40-50	**8.30**			Camden Bay 6.5m
944036	7003.16	14512.30	4/25/94	60-70	**9.28**			Camden Bay 6.5m
944036	7003.16	14512.30	4/25/94	80-90	**7.89**			Camden Bay 6.5m
944036	7003.16	14512.30	4/25/94	100-110	**8.67**			Camden Bay 6.5m
944036	7003.16	14512.30	4/25/94	120-130	**8.36**			Camden Bay 6.5m
944036	7003.16	14512.30	4/25/94	140-150	**12.15**			Camden Bay 6.5m
944305	7051.98	15212.12	4/26/94	0-10	**15.25**			Transect 3 6 m Cape Halkett
944305	7051.98	15212.12	4/26/94	20-30	**17.95**			Transect 3 6 m Cape Halkett
944305	7051.98	15212.12	4/26/94	70-80	**14.03**			Transect 3 6 m Cape Halkett
944305	7051.98	15212.12	4/26/94	180-190	**6.21**			Transect 3 6 m Cape Halkett
944320	7105.00	15212.01	4/26/94	0-10	**7.25**			Transect 3 16 m Cape Halkett
944320	7105.00	15212.01	4/26/94	20-30	**6.62**			Transect 3 16 m Cape Halkett
944320	7105.00	15212.01	4/26/94	60-70	**24.04**			Transect 3 16 m Cape Halkett
944320	7105.00	15212.01	4/26/94	140-150	**16.15**			Transect 3 16 m Cape Halkett
944320R	7105.00	15212.01	4/26/94	0-10	**9.12**			Transect 3 16 m Cape Halkett repeat
944320R	7105.00	15212.01	4/26/94	20-30	**8.52**			Transect 3 16 m Cape Halkett repeat
944320R	7105.00	15212.01	4/26/94	60-70	**5.24**			Transect 3 16 m Cape Halkett repeat
944350	7119.01	15212.43	4/26/94	0-10	**11.50**			Transect 3 57 m Cape Halkett
944350	7119.01	15212.43	4/26/94	20-30	**10.54**			Transect 3 57 m Cape Halkett
944350	7119.01	15212.43	4/26/94	70-80	**7.79**			Transect 3 57 m Cape Halkett
944350	7119.01	15212.43	4/26/94	150-160	**10.69**			Transect 3 57 m Cape Halkett

Table 3. Methane concentrations (nM, nanomoles methane per liter melted ice), and methane carbon isotopic composition in ice.

Station	Latitude N.	Longitude W.	Date	Core interval (cm)	Methane (nM)	Carbon Isotopic Composition (ppt)	Carbon Isotopic Composition (ppt) duplicate	Description
944502	7021.46	14757.63	4/23/94	0-10	**22.46**			Transect 5 02 m Endicott
944502	7021.46	14757.63	4/23/94	20-30	**74.19**	-59.884		Transect 5 02 m Endicott
944502	7021.46	14757.63	4/23/94	40-50	**129.46**	-58.883		Transect 5 02 m Endicott
944502	7021.46	14757.63	4/23/94	60-70	**79.07**	-61.146		Transect 5 02 m Endicott
944502	7021.46	14757.63	4/23/94	80-90	**41.42**			Transect 5 02 m Endicott
944502	7021.46	14757.63	4/23/94	90-100	**47.54**			Transect 5 02 m Endicott
944502	7021.46	14757.63	4/23/94	110-120	**384.99**	-57.821	-52.404	Transect 5 02 m Endicott
944502	7021.46	14757.63	4/23/94	120-130	**10.89**			Transect 5 02 m Endicott
944502	7021.46	14757.63	4/23/94	150-160	**20.06**			Transect 5 02 m Endicott
944502	7021.46	14757.63	4/23/94	180-190	**11.15**			Transect 5 02 m Endicott
944503R	7021.24	14757.09	4/23/94	0-10	**80.43**	-52.146		Transect 5 03 m Endicott Dock repeat
944503R	7021.24	14757.09	4/23/94	20-30	**47.35**			Transect 5 03 m Endicott Dock repeat
944503R	7021.24	14757.09	4/23/94	40-50	**65.74**	-62.112		Transect 5 03 m Endicott Dock repeat
944503R	7021.24	14757.09	4/23/94	60-70	**78.89**	-56.481	-61.928	Transect 5 03 m Endicott Dock repeat
944503R	7021.24	14757.09	4/23/94	80-90	**17.12**			Transect 5 03 m Endicott Dock repeat
944503R	7021.24	14757.09	4/23/94	100-110	**38.08**			Transect 5 03 m Endicott Dock repeat
944503R	7021.24	14757.09	4/23/94	120-130	**18.59**			Transect 5 03 m Endicott Dock repeat
944503R	7021.24	14757.09	4/23/94	140-150	**14.36**			Transect 5 03 m Endicott Dock repeat
944605	7015.02	14700.02	4/25/94	0-10	**35.55**			Transect 6 05 m Mikkelsen Bay
944605	7015.02	14700.02	4/25/94	20-30	**23.90**			Transect 6 05 m Mikkelsen Bay
944605	7015.02	14700.02	4/25/94	40-50	**26.44**			Transect 6 05 m Mikkelsen Bay
944605	7015.02	14700.02	4/25/94	60-70	**23.29**			Transect 6 05 m Mikkelsen Bay
944605	7015.02	14700.02	4/25/94	80-90	**37.09**			Transect 6 05 m Mikkelsen Bay
944605	7015.02	14700.02	4/25/94	100-110	**30.47**			Transect 6 05 m Mikkelsen Bay
944605	7015.02	14700.02	4/25/94	120-130	**19.89**			Transect 6 05 m Mikkelsen Bay
944605	7015.02	14700.02	4/25/94	140-150	**24.83**			Transect 6 05 m Mikkelsen Bay
944605	7015.02	14700.02	4/25/94	150-160	**21.89**			Transect 6 05 m Mikkelsen Bay
944605R	7015.02	14700.02	4/27/94	0-10	**18.06**			Transect 6 05 m Mikkelsen Bay repeat
944605R	7015.02	14700.02	4/27/94	10_20	**23.57**	-72.995	-76.132	Transect 6 05 m Mikkelsen Bay repeat
944605R	7015.02	14700.02	4/27/94	20-30	**24.10**			Transect 6 05 m Mikkelsen Bay repeat
944605R	7015.02	14700.02	4/27/94	70-80	**55.13**	-83.363		Transect 6 05 m Mikkelsen Bay repeat
944605R	7015.02	14700.02	4/27/94	100-110	**26.28**			Transect 6 05 m Mikkelsen Bay repeat
944605R	7015.02	14700.02	4/27/94	140-150	**20.73**			Transect 6 05 m Mikkelsen Bay repeat
944605R	7015.02	14700.02	4/27/94	160-170	**11.95**			Transect 6 05 m Mikkelsen Bay repeat
944620	7023.02	147 00.706	4/27/94	0-10	**11.04**			Transect 6 19 m Mikkelsen Bay
944620	7023.02	147 00.706	4/27/94	20-30	**11.81**			Transect 6 19 m Mikkelsen Bay
944620	7023.02	147 00.706	4/27/94	70-80	**15.28**			Transect 6 19 m Mikkelsen Bay
944620	7023.02	147 00.706	4/27/94	170-180	**13.36**			Transect 6 19 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	0-10	**11.52**			Transect 6 49 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	20-30	**7.51**			Transect 6 49 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	70-80	**8.12**			Transect 6 49 m Mikkelsen Bay
944650	7050.11	14700.04	4/27/94	140-150	**6.21**			Transect 6 49 m Mikkelsen Bay

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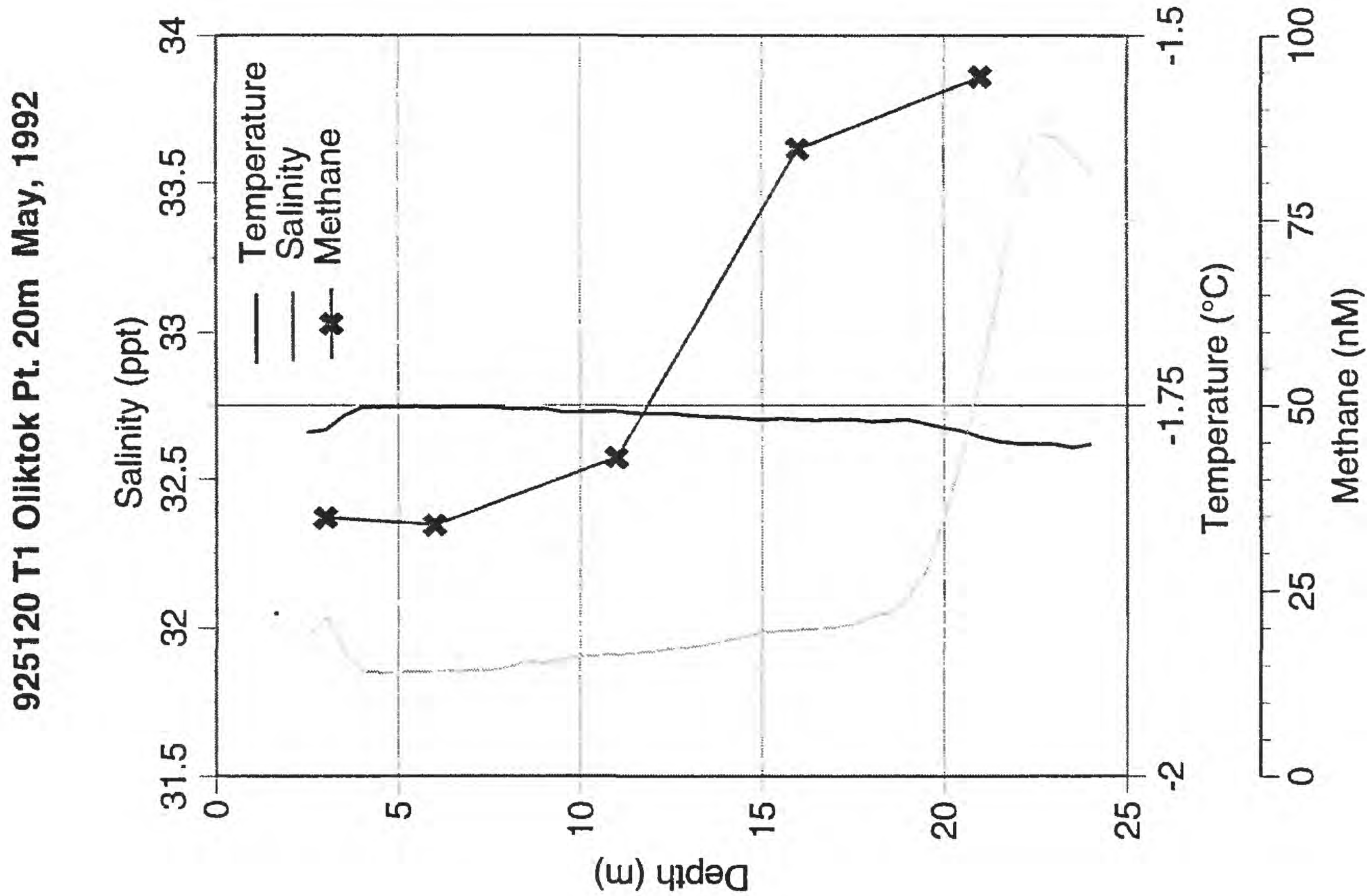
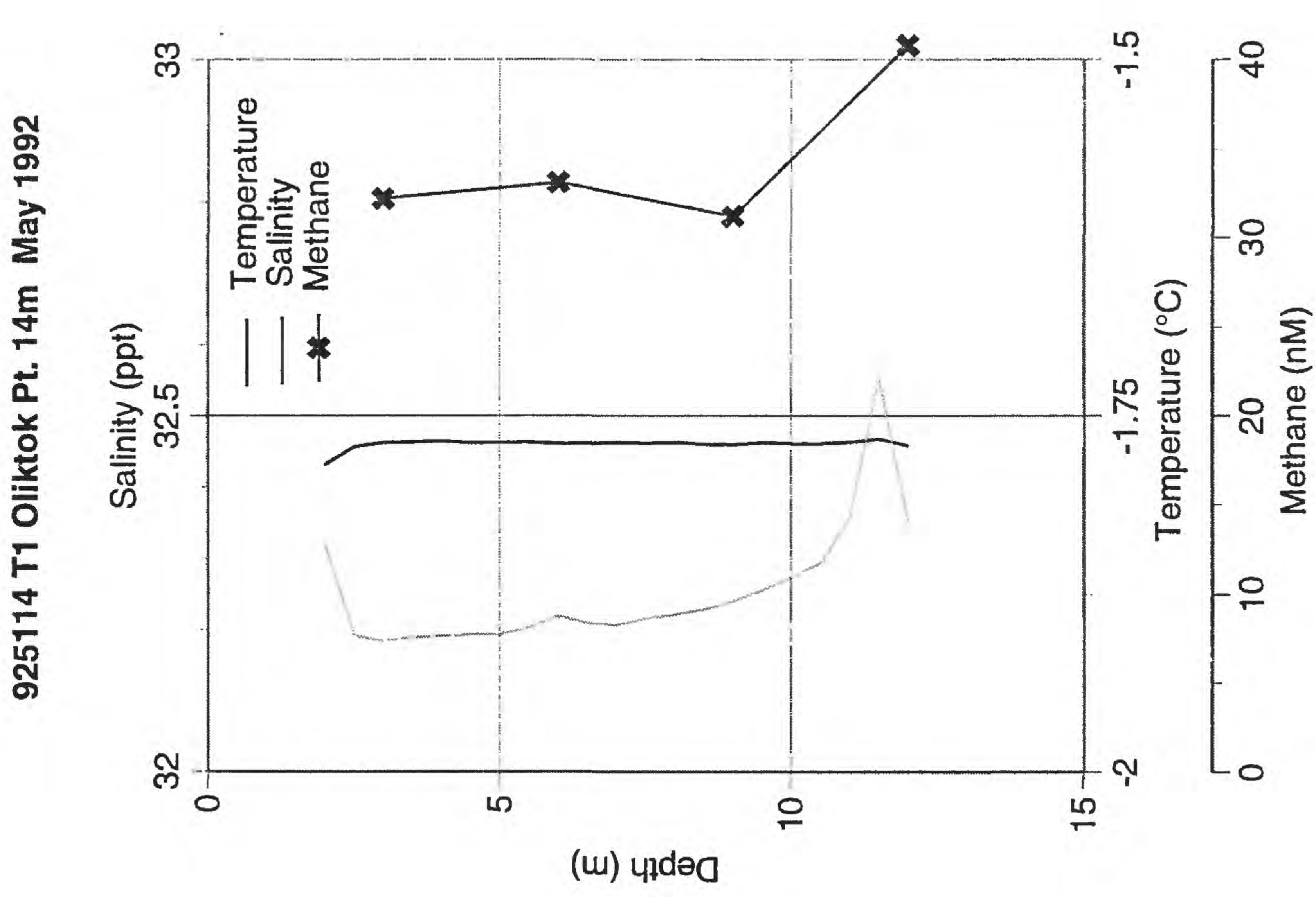
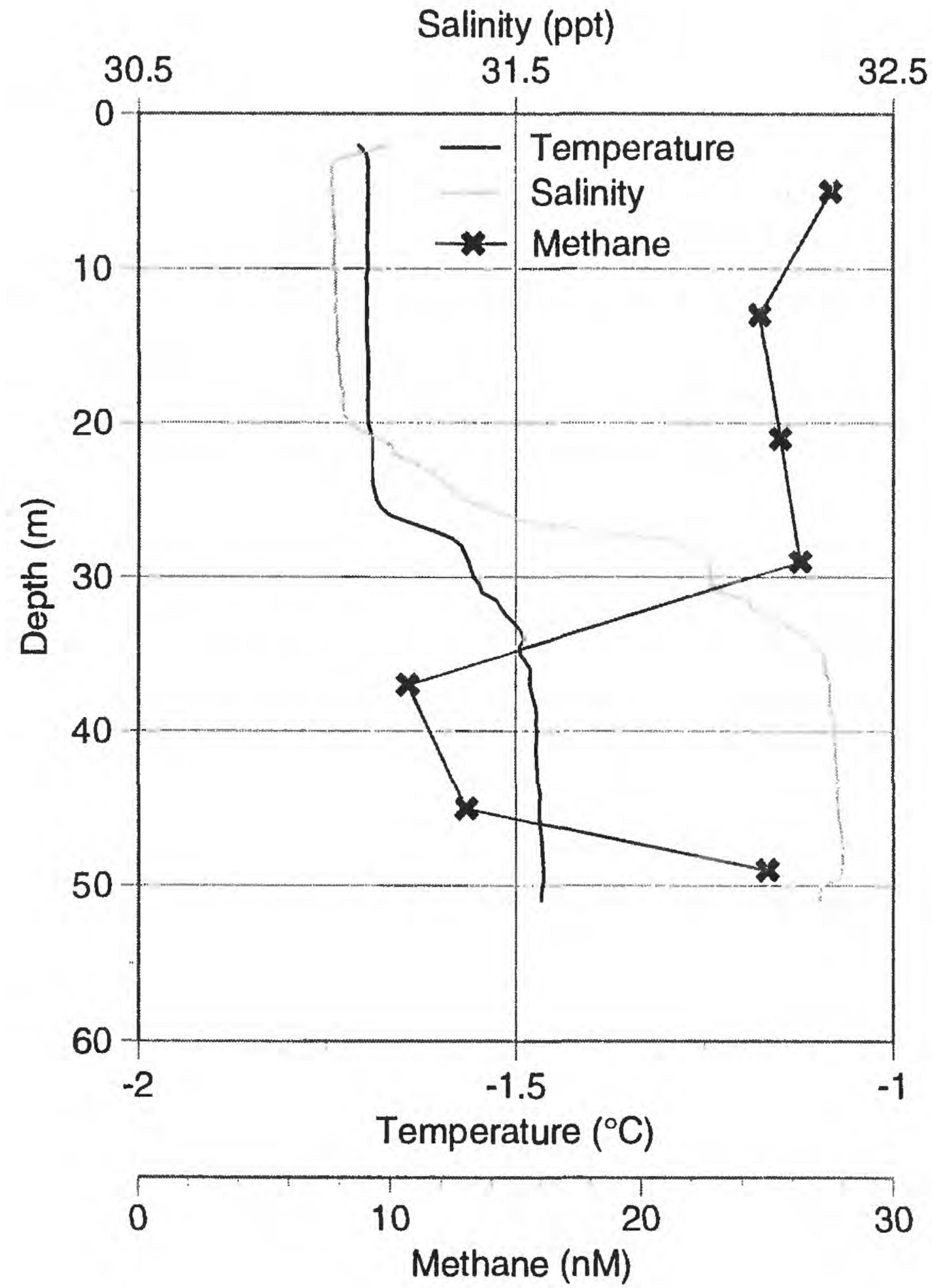
Appendix 1

Water Temperature - Salinity - Methane concentrations plotted with water depth for each station

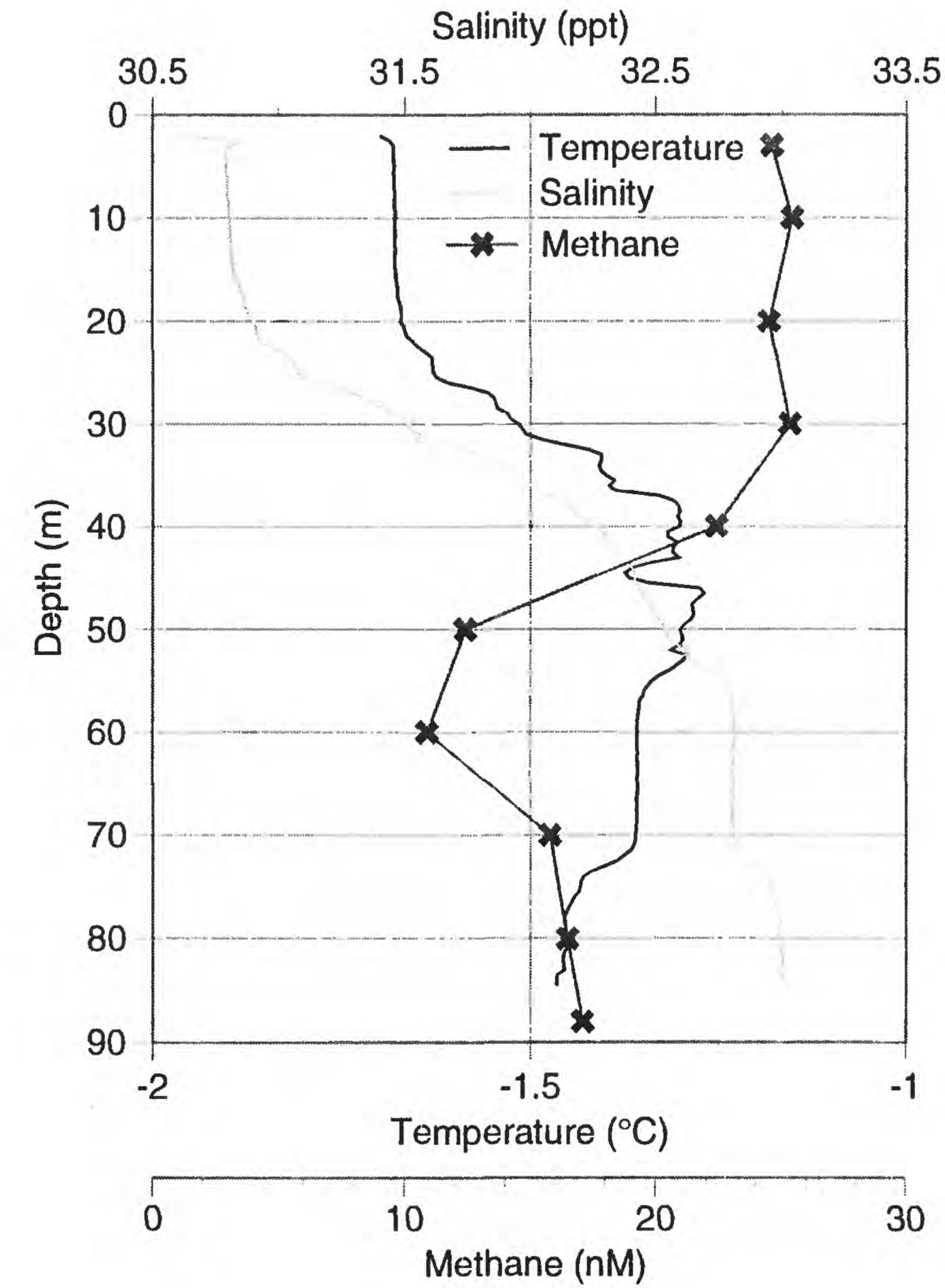

925120 T1 Oliktok Pt. 20m May, 1992
Salinity (ppt)
31.5
32
32.5
33
33.5
34
Temperature
Salinity
Methane
Depth (m)
0
5
10
15
20
25
Temperature (°C)
-2
-1.75
-1.5
Methane (nM)
0
25
50
75
100


925114 T1 Oliktok Pt. 14m May 1992
Salinity (ppt)
32
32.5
33
Temperature
Salinity
Methane
Depth (m)
0
5
10
15
Temperature (°C)
-2
-1.75
-1.5
Methane (nM)
0
10
20
30
40

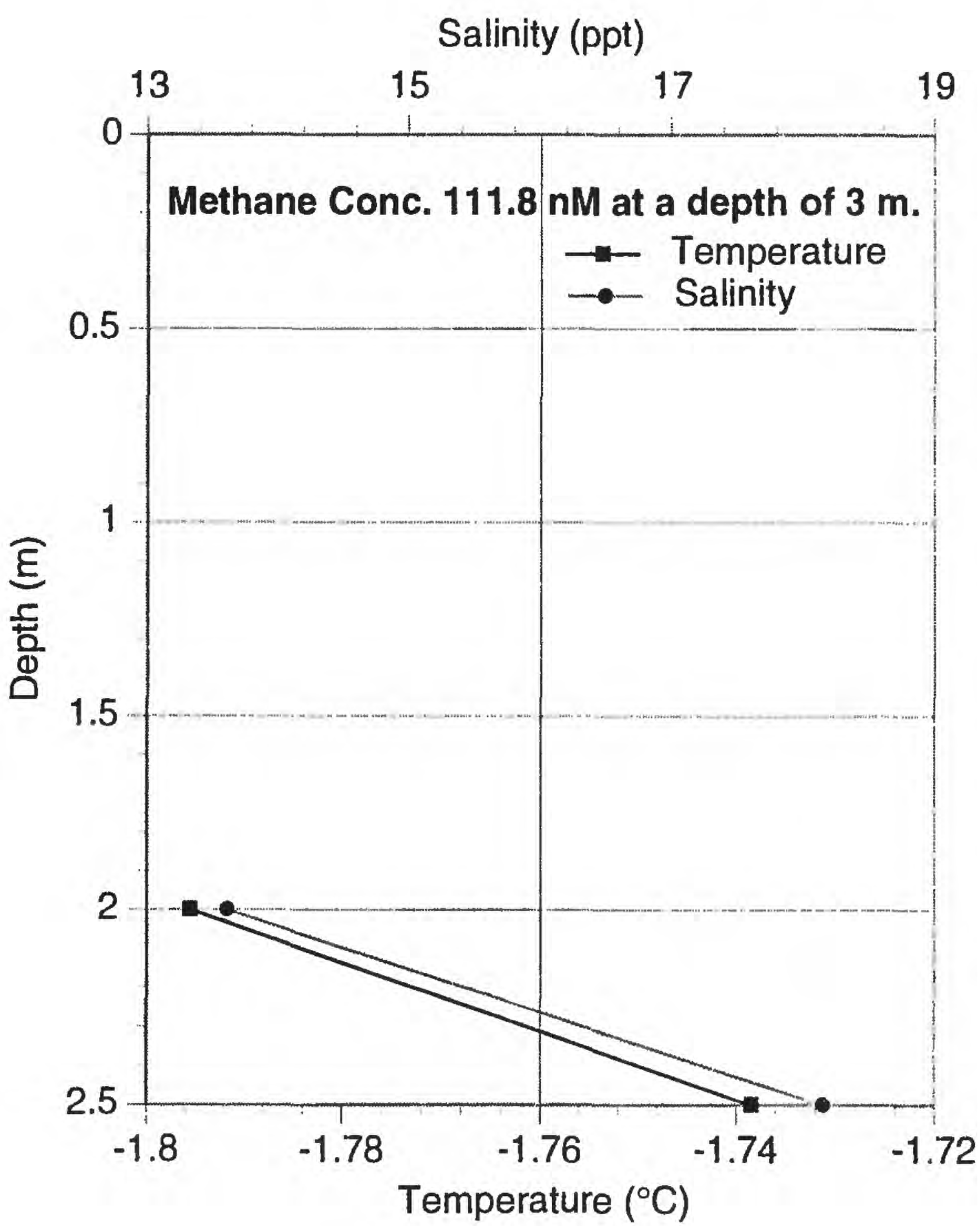
925150 T1 Oliktok Pt. 50m   May, 1992



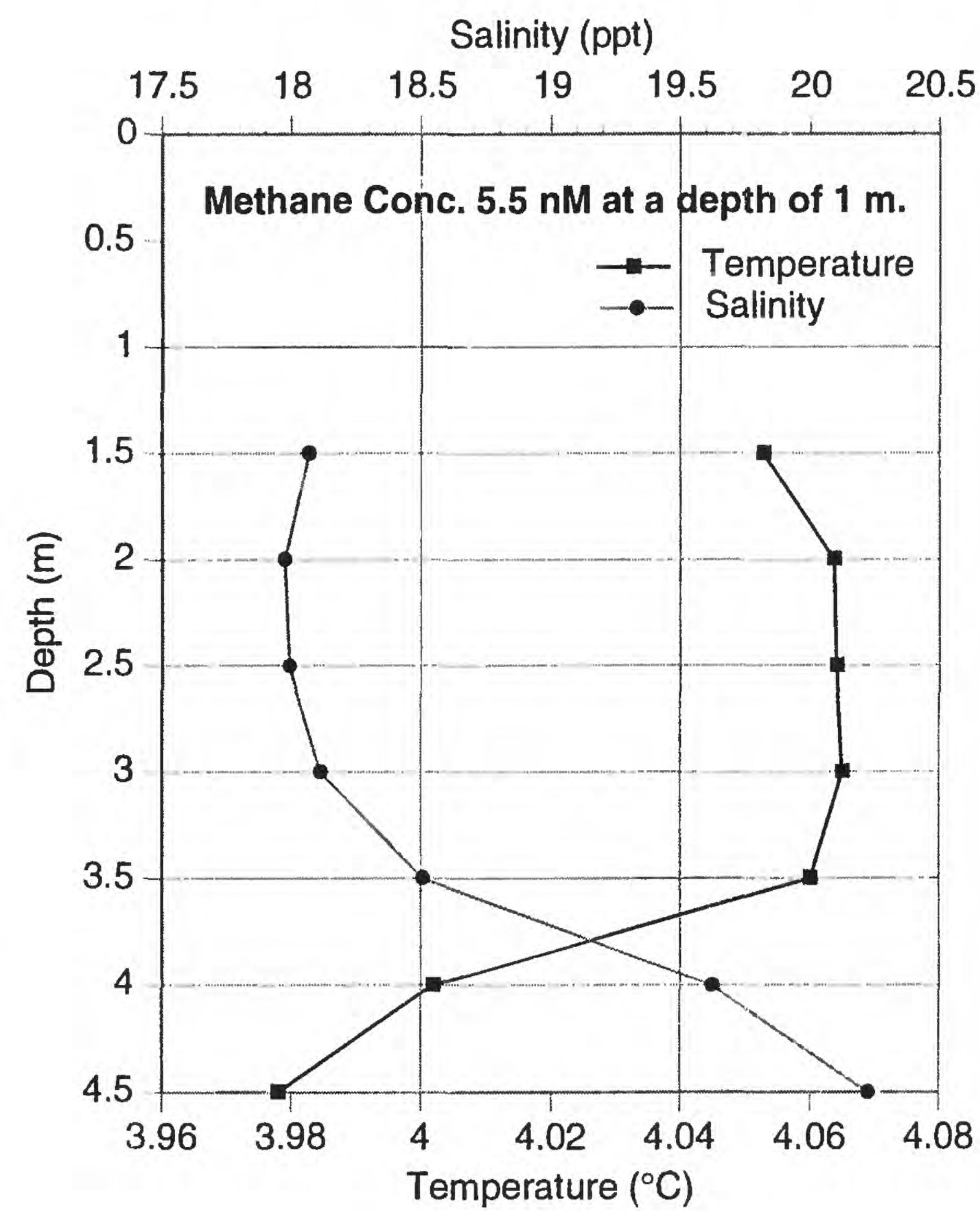
925188 T1 Oliktok Pt. 88m May, 1992

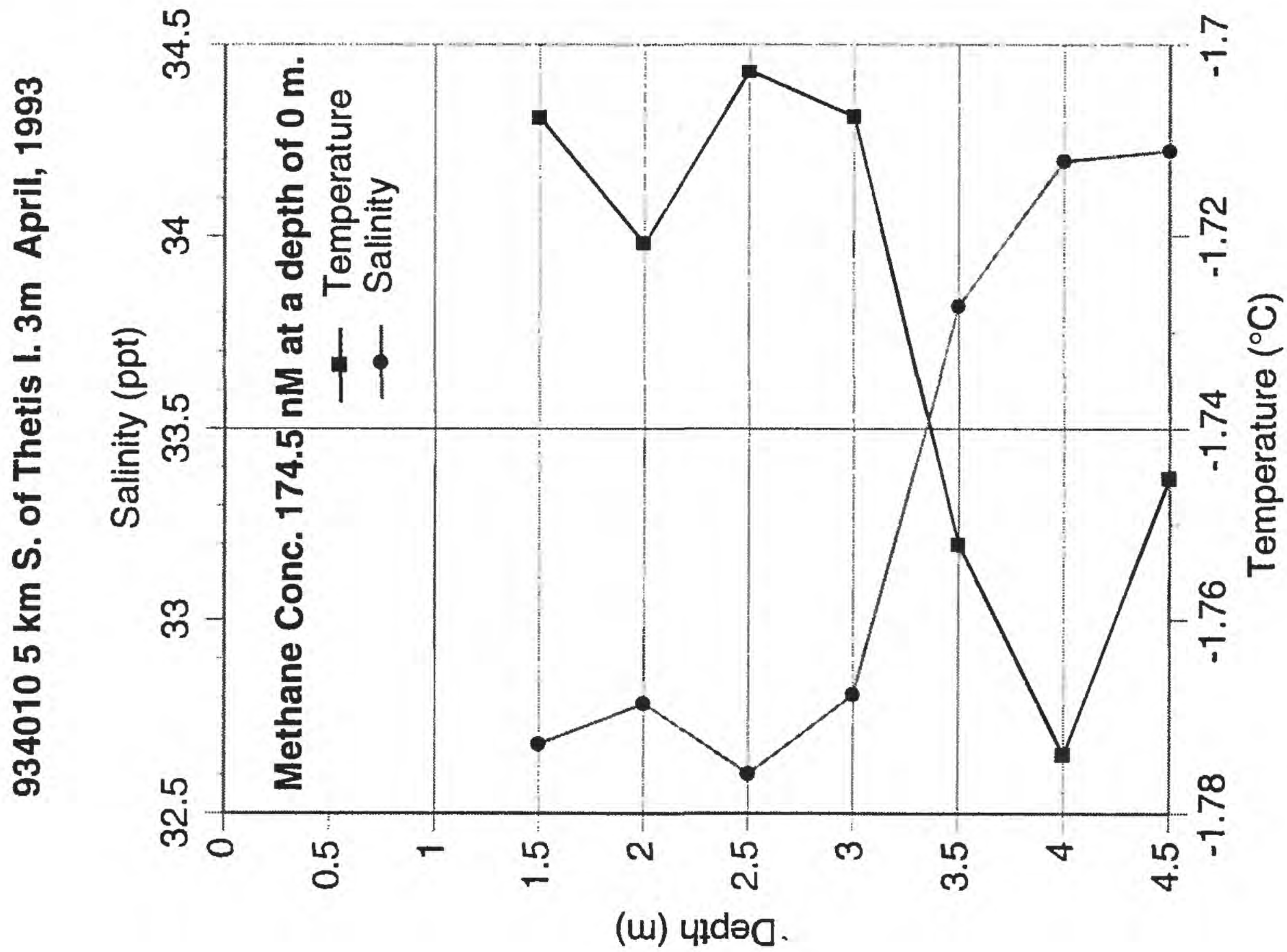


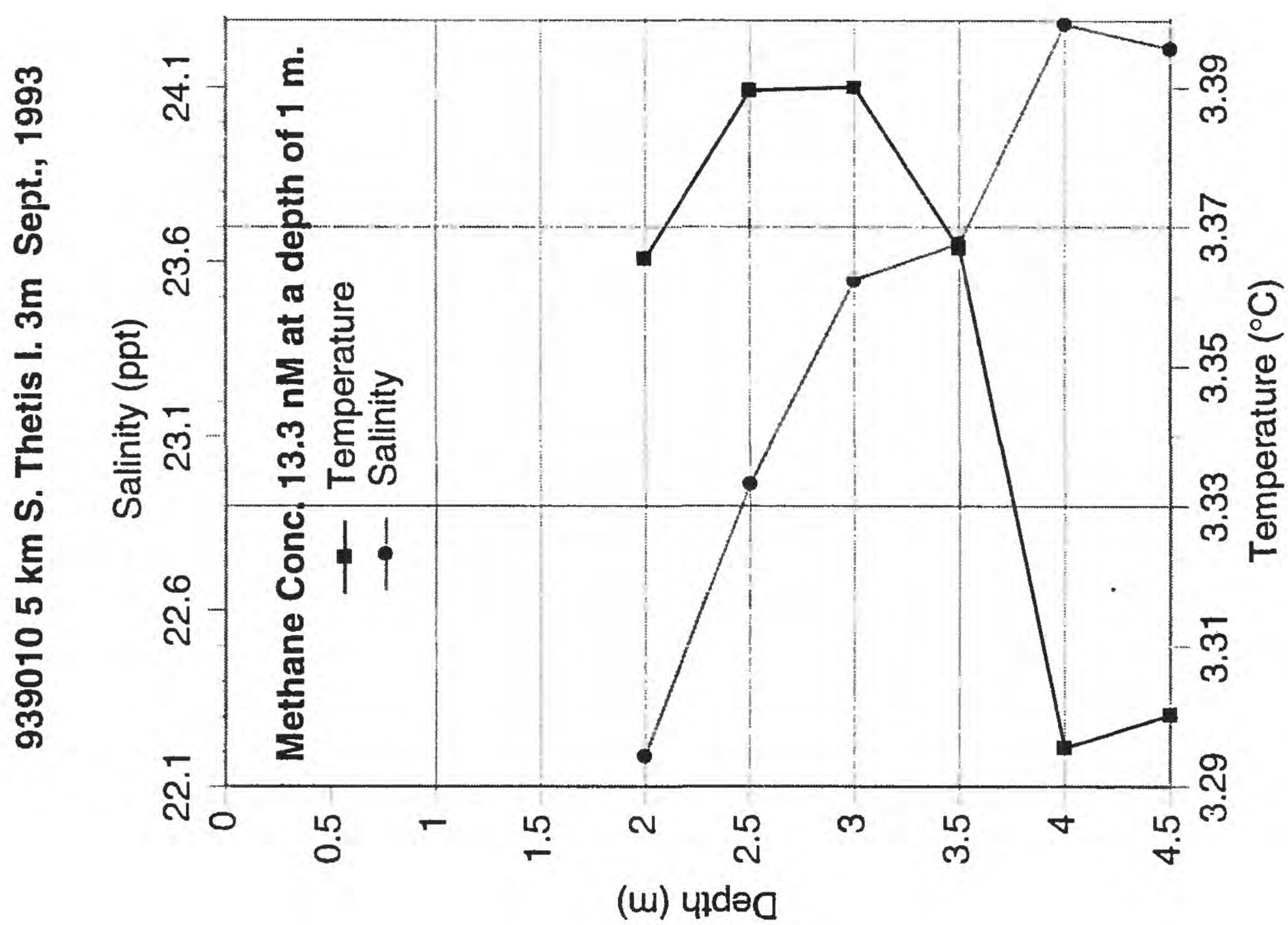
925010 5 km S. of Thetis I. 3m May, 1992



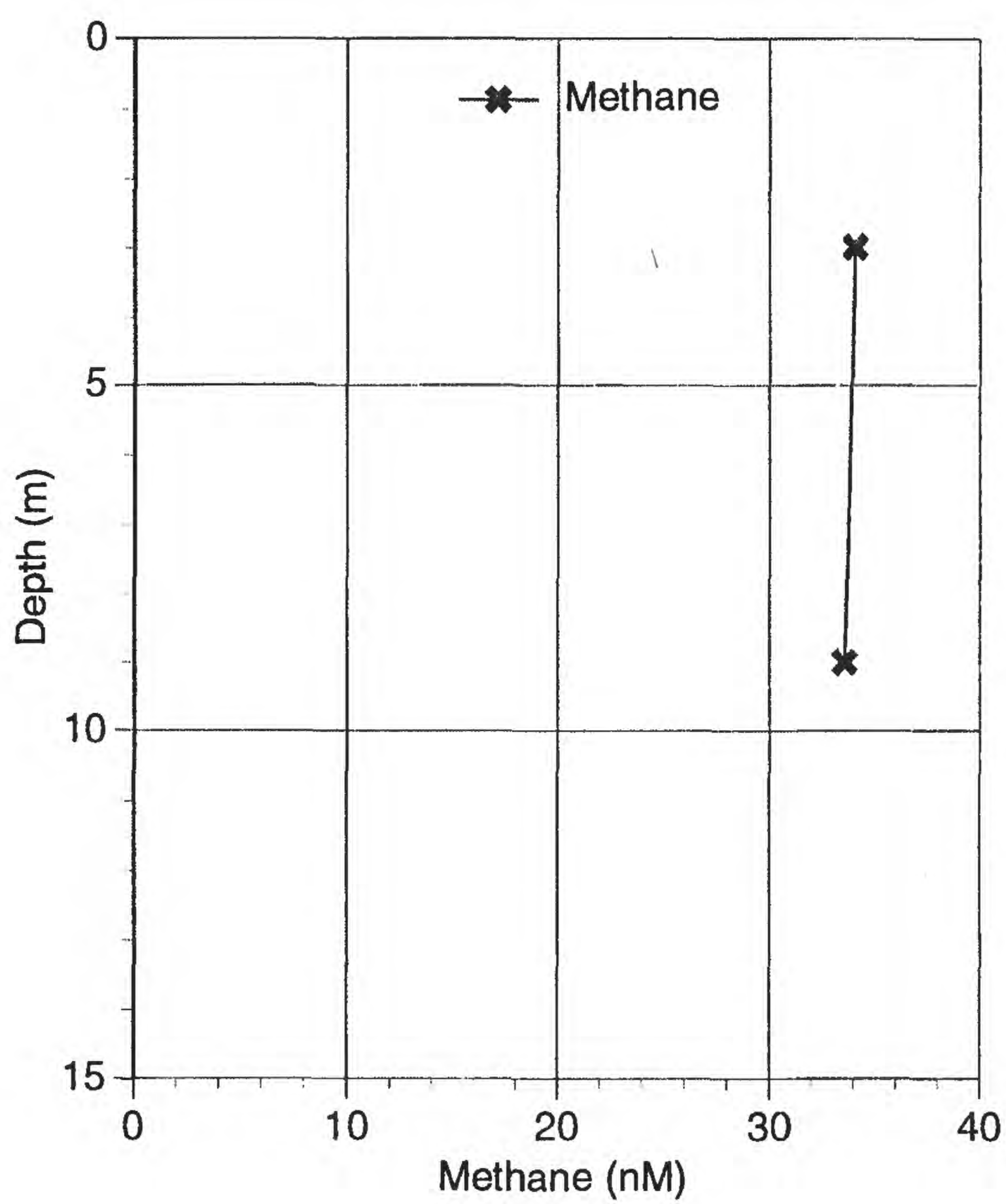
939001 West Dock, Prudhoe Bay 4m April,1993



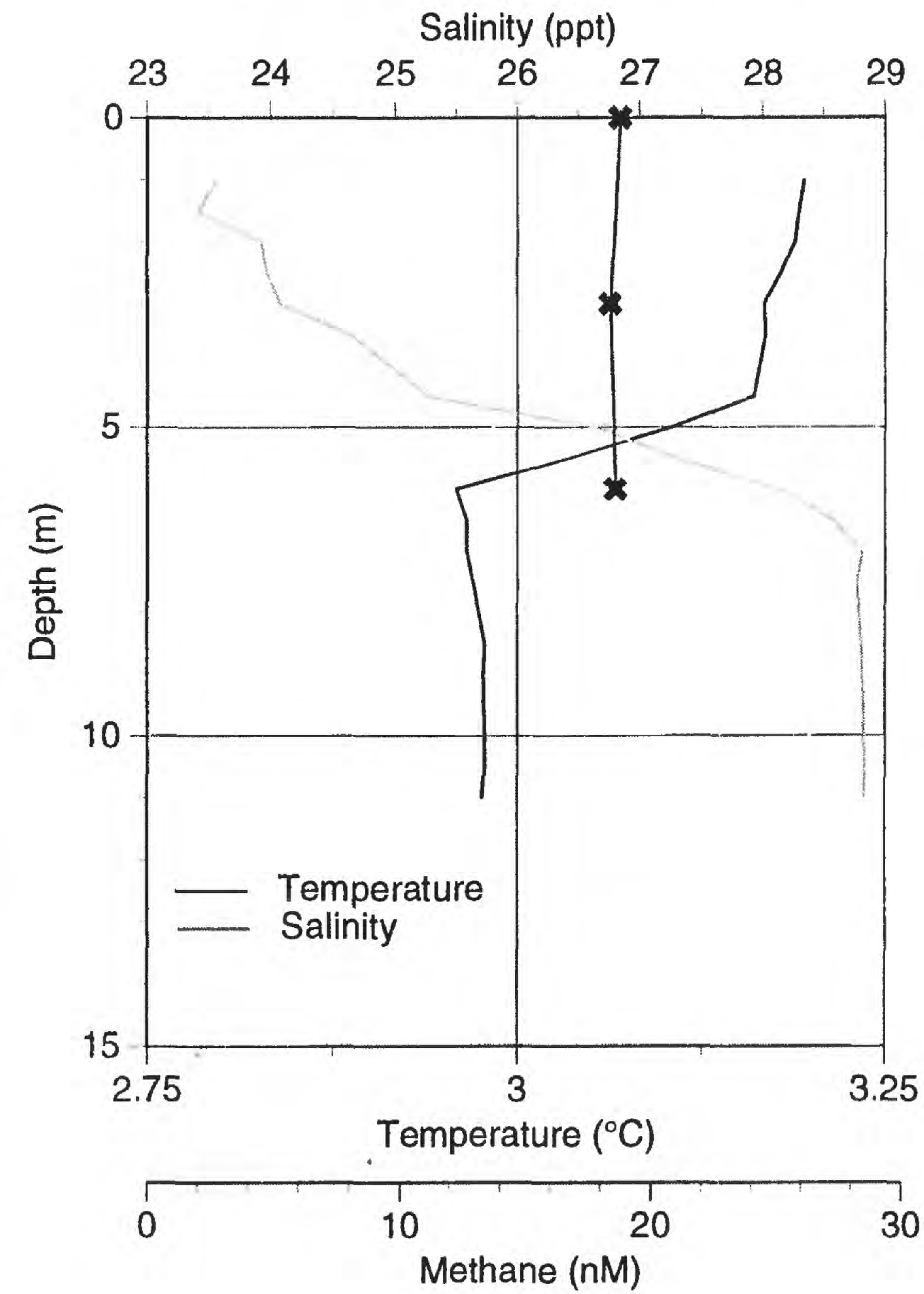

934010 5 km S. of Thetis I. 3m April, 1993
Salinity (ppt)
32.5
33
33.5
34
34.5
Methane Conc. 174.5 nM at a depth of 0 m.
Temperature
Salinity
Depth (m)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
-1.78
-1.76
-1.74
-1.72
-1.7
Temperature (°C)


939010 5 km S. Thetis I. 3m Sept., 1993
Salinity (ppt)
22.1
22.6
23.1
23.6
24.1
Methane Conc. 13.3 nM at a depth of 1 m.
Temperature
Salinity
Depth (m)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
3.29
3.31
3.33
3.35
3.37
3.39
Temperature (°C)

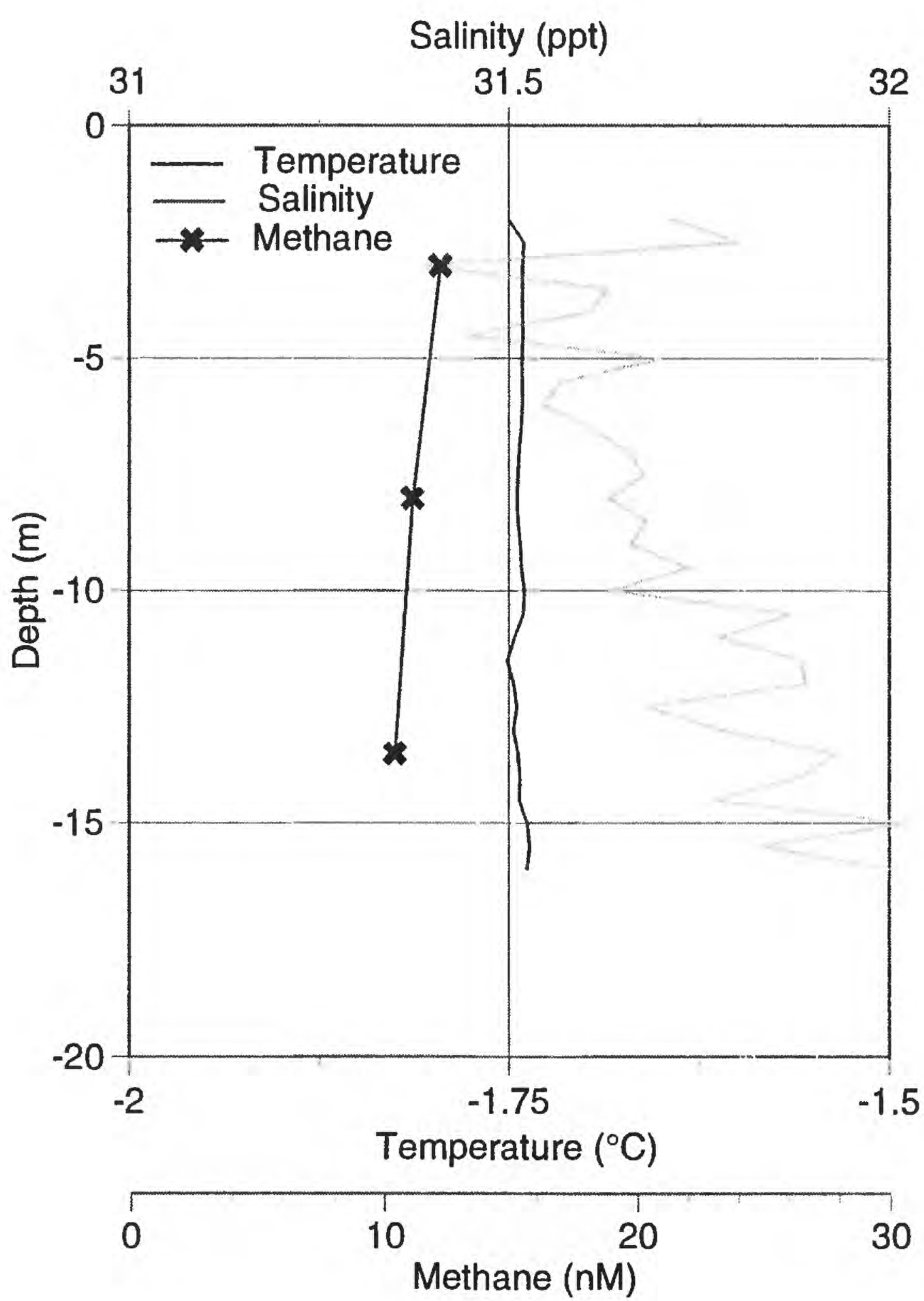
934030 Colville R. 10m April, 1993



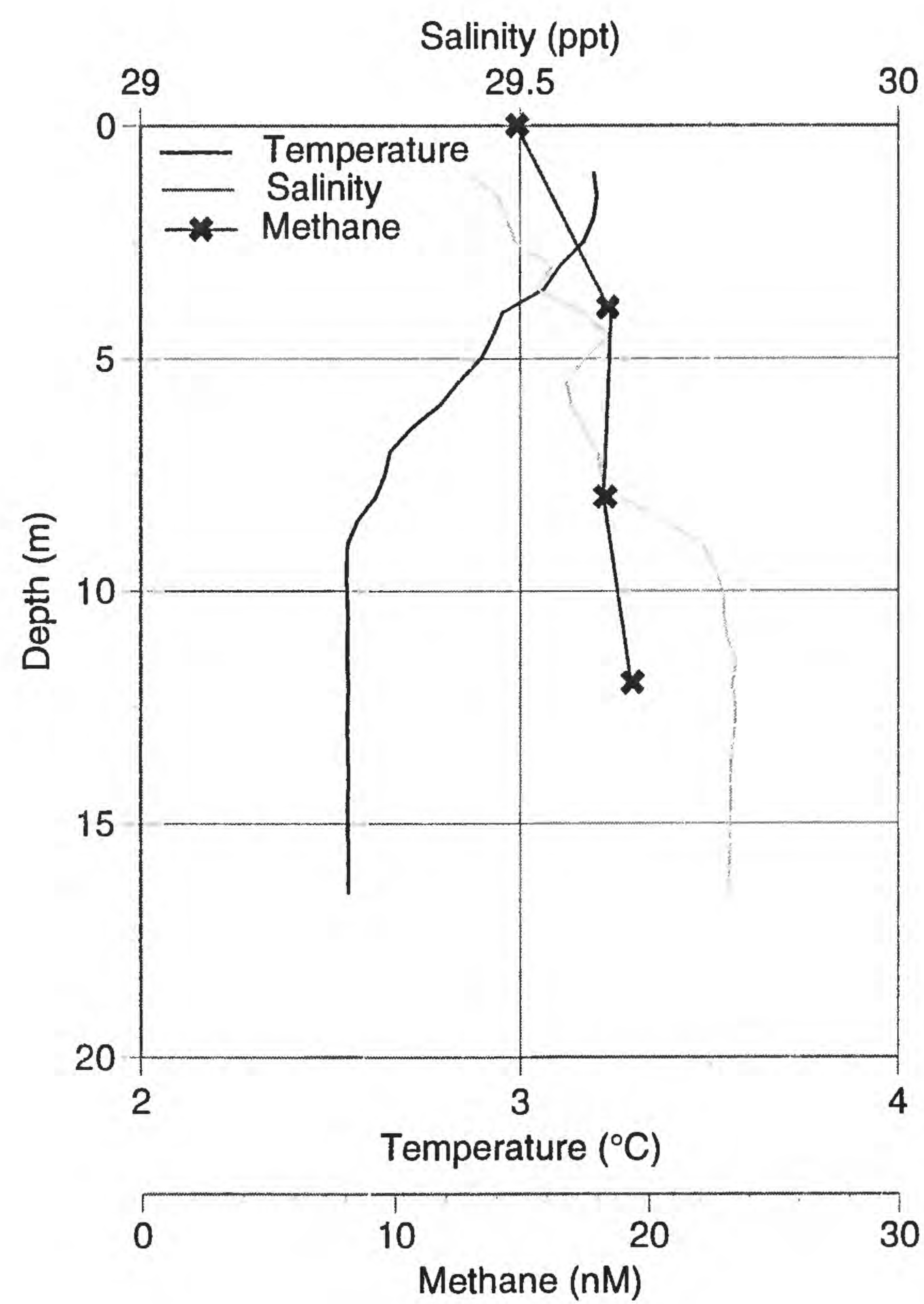
939030 Colville R. 10m Sept., 1993



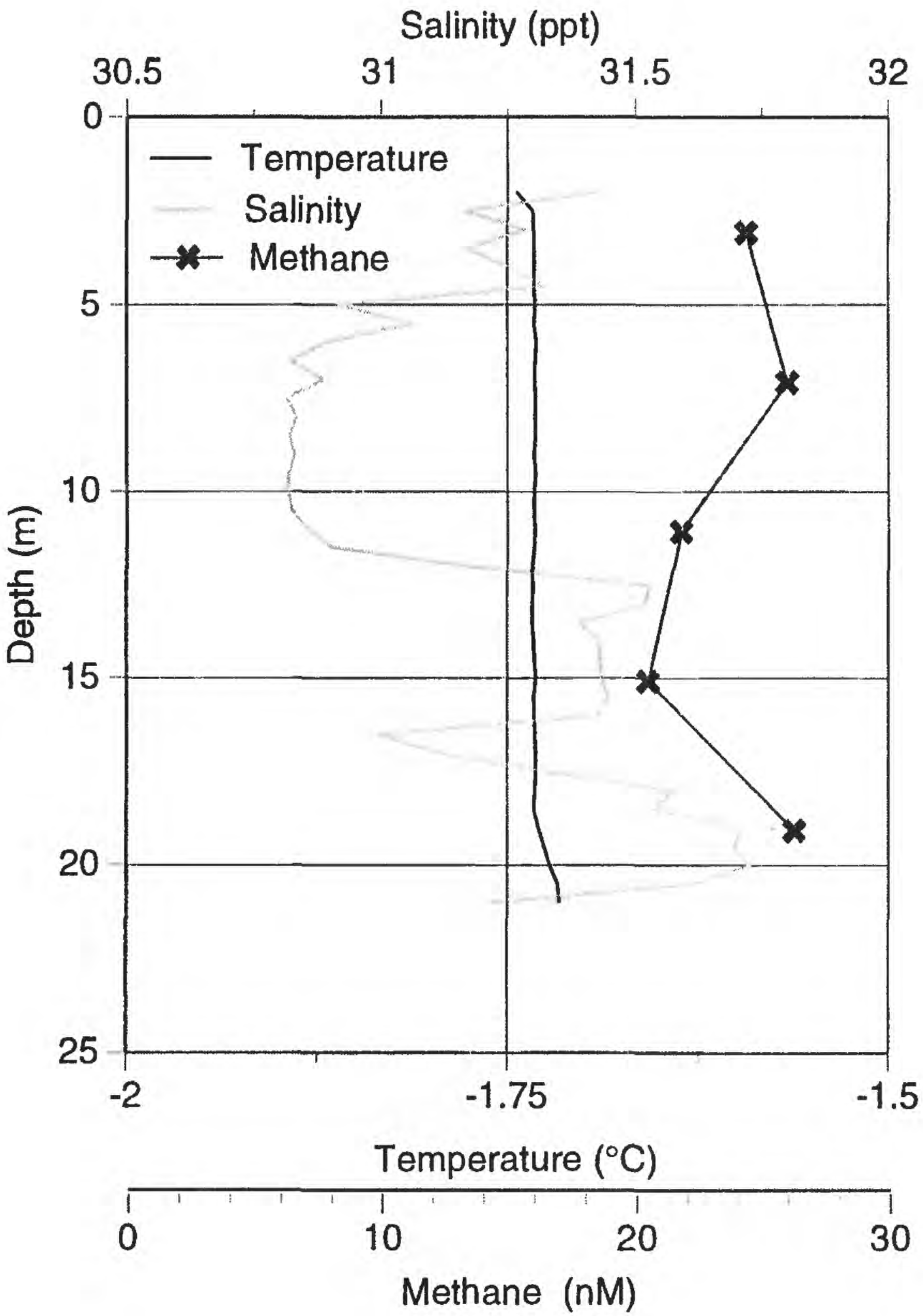
934114 T1 Oliktok Pt. 14m April, 1993



939114 T1 Oliktok Pt. 14m Sept., 1993



934120 T1 Oliktok Pt. 20m April 1993



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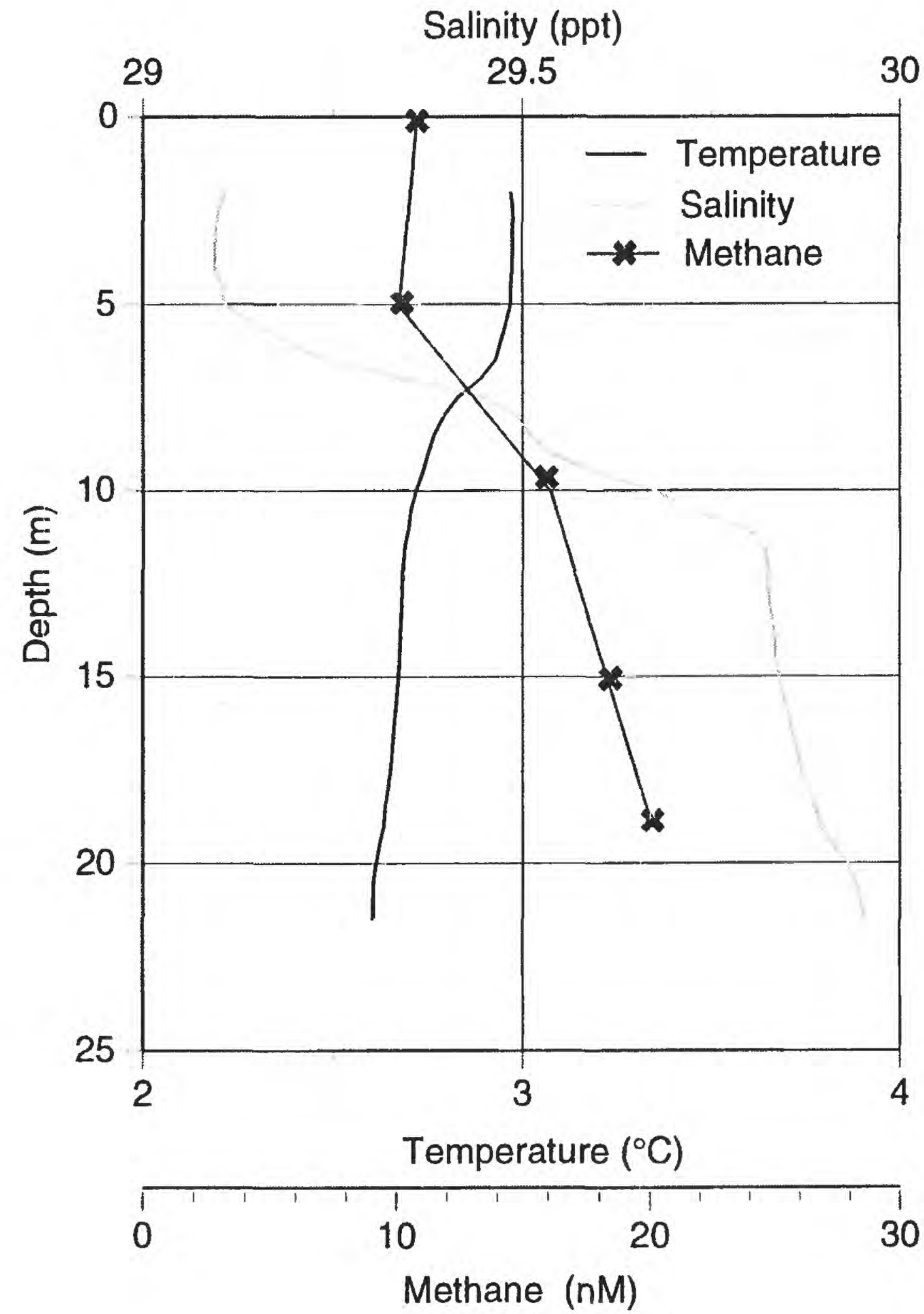
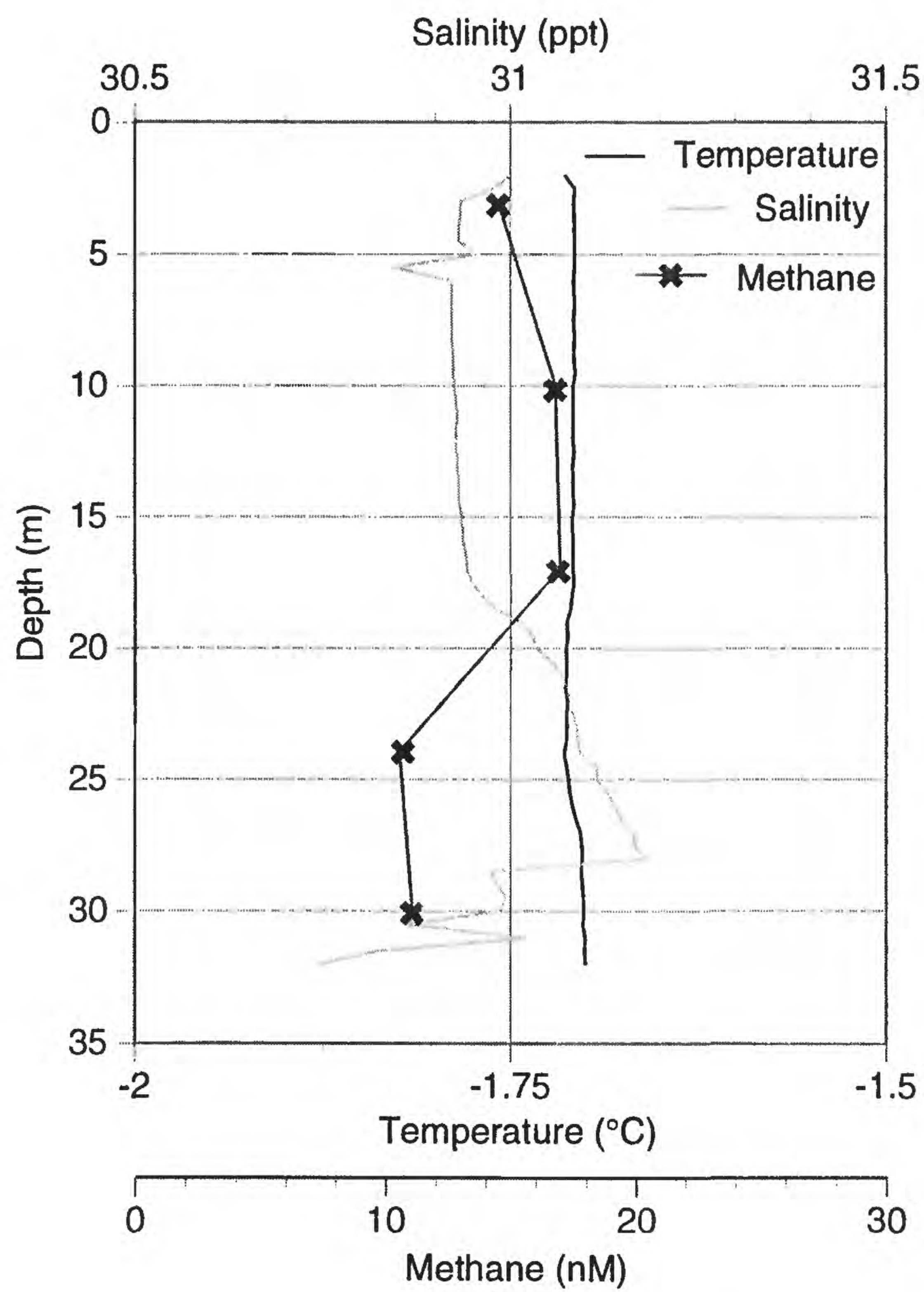


934130 T1 Oliktok Pt. 30m April, 1993



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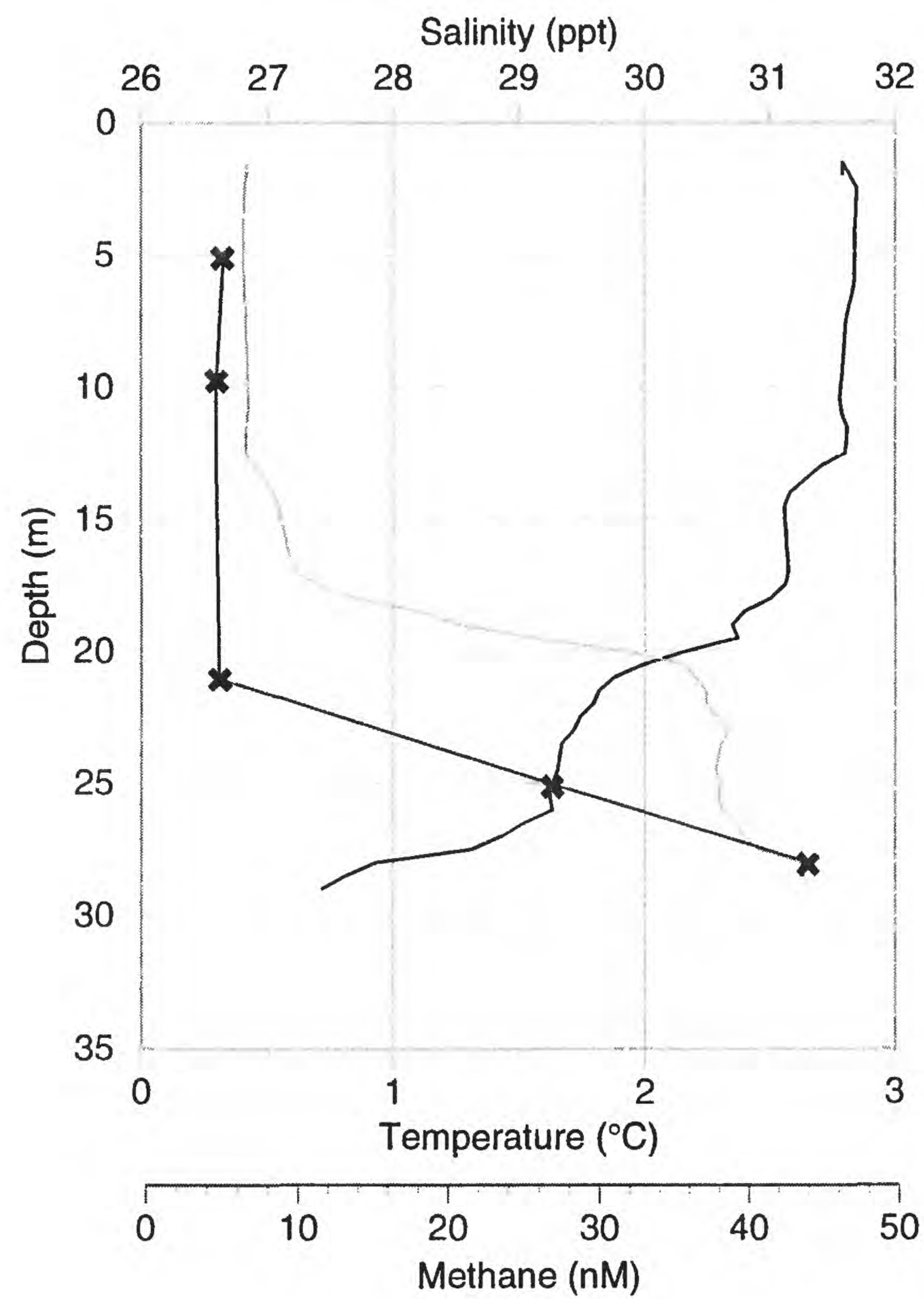
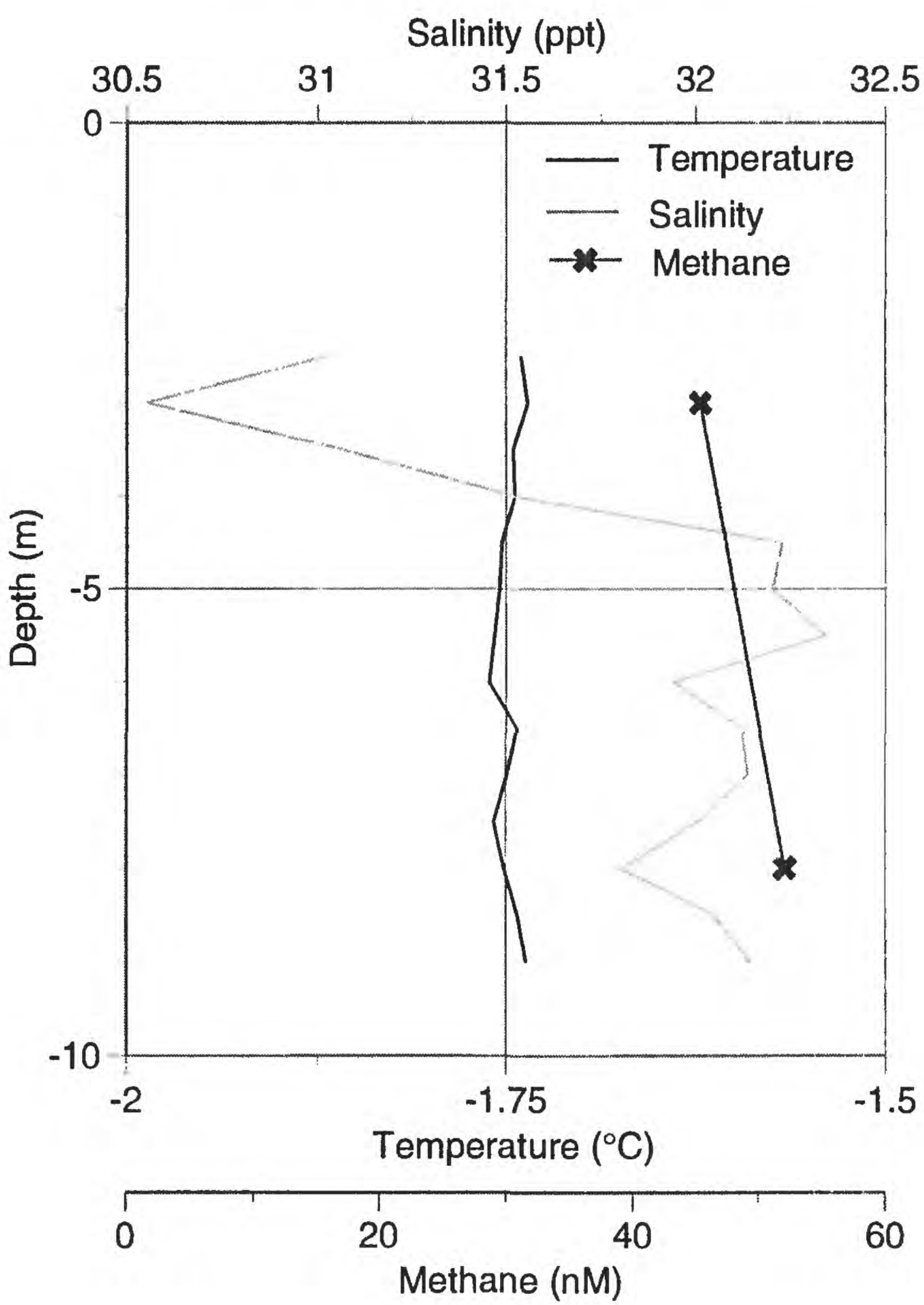


934210 T2 Colville R. 10m April, 1993



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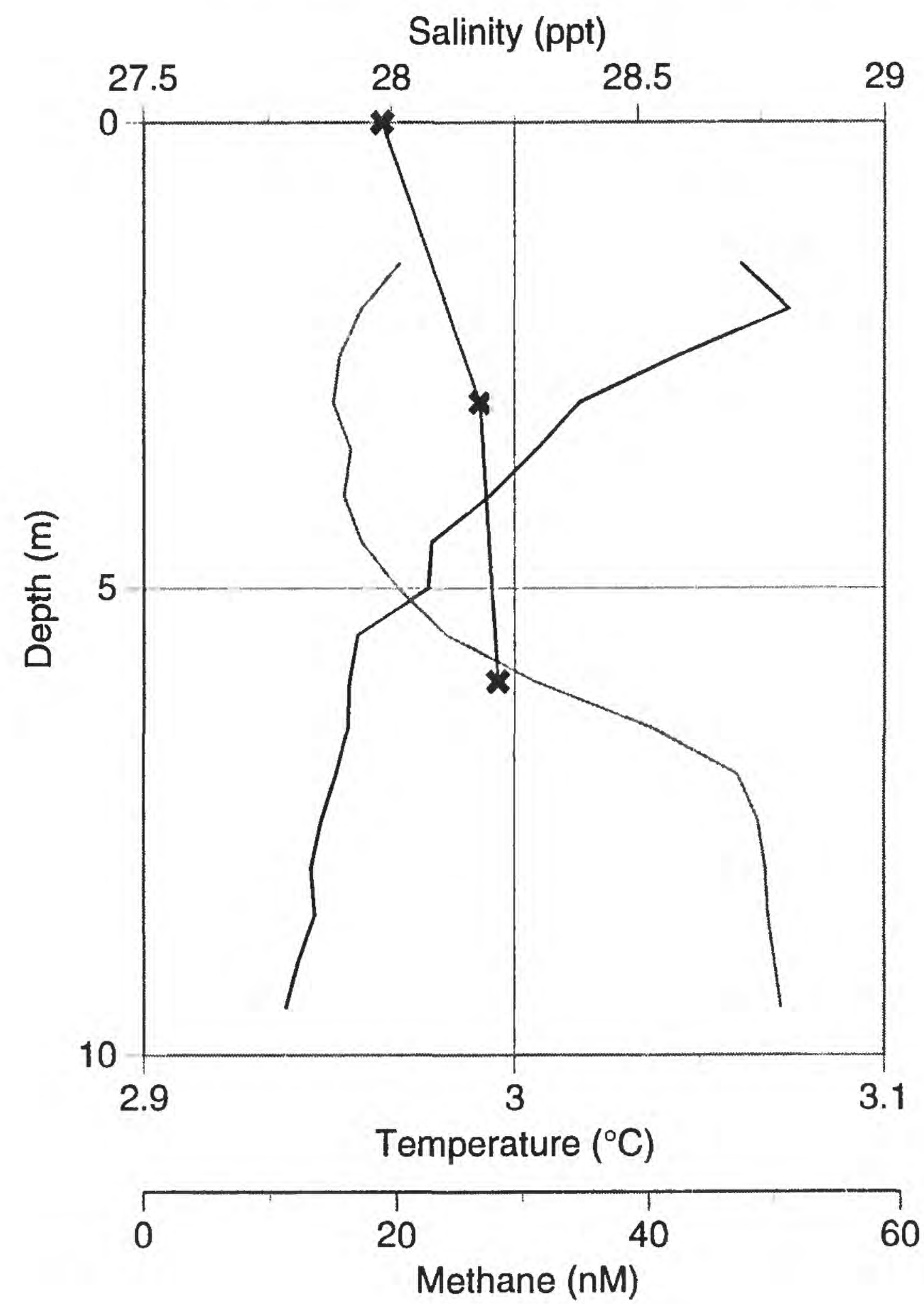
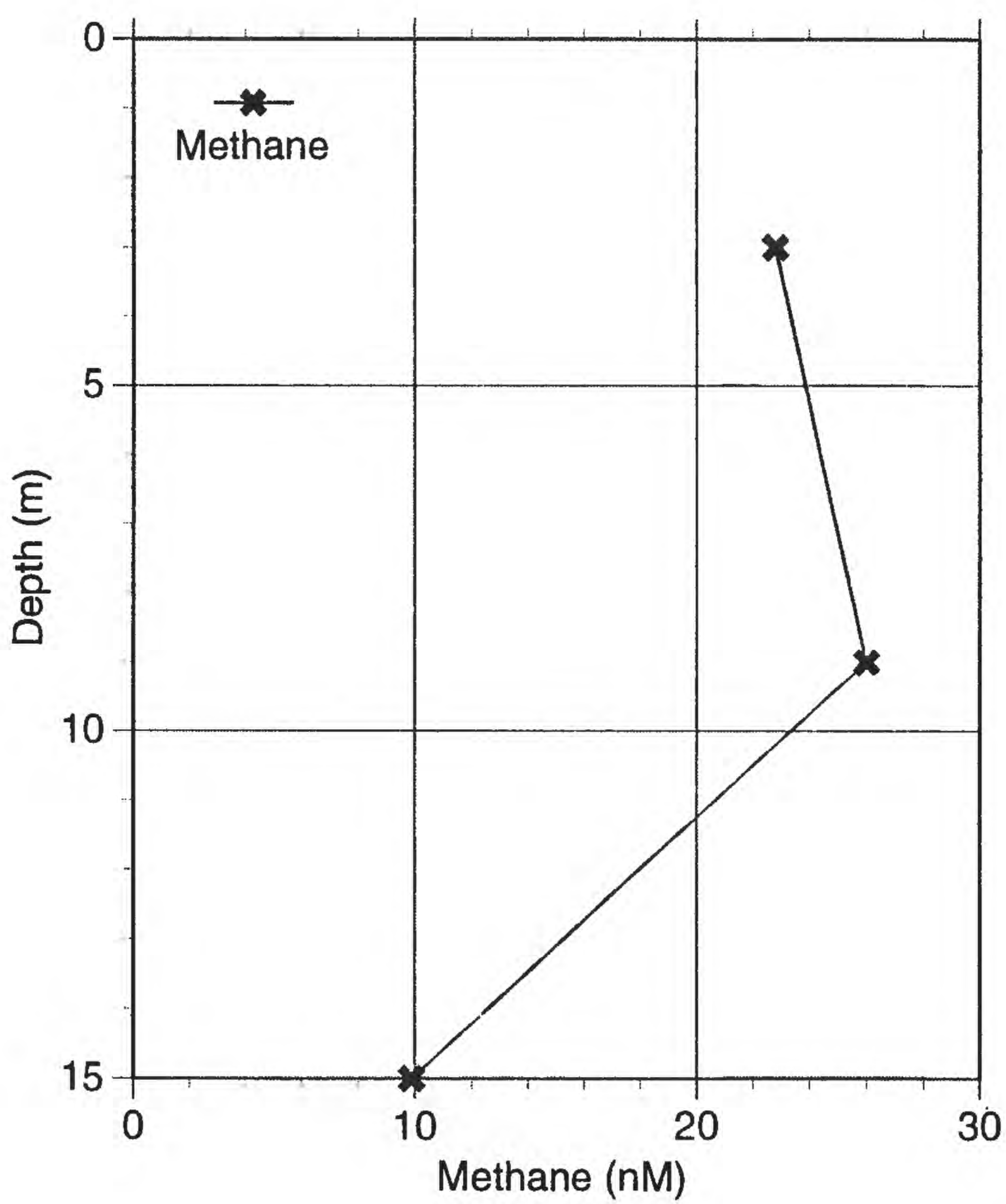
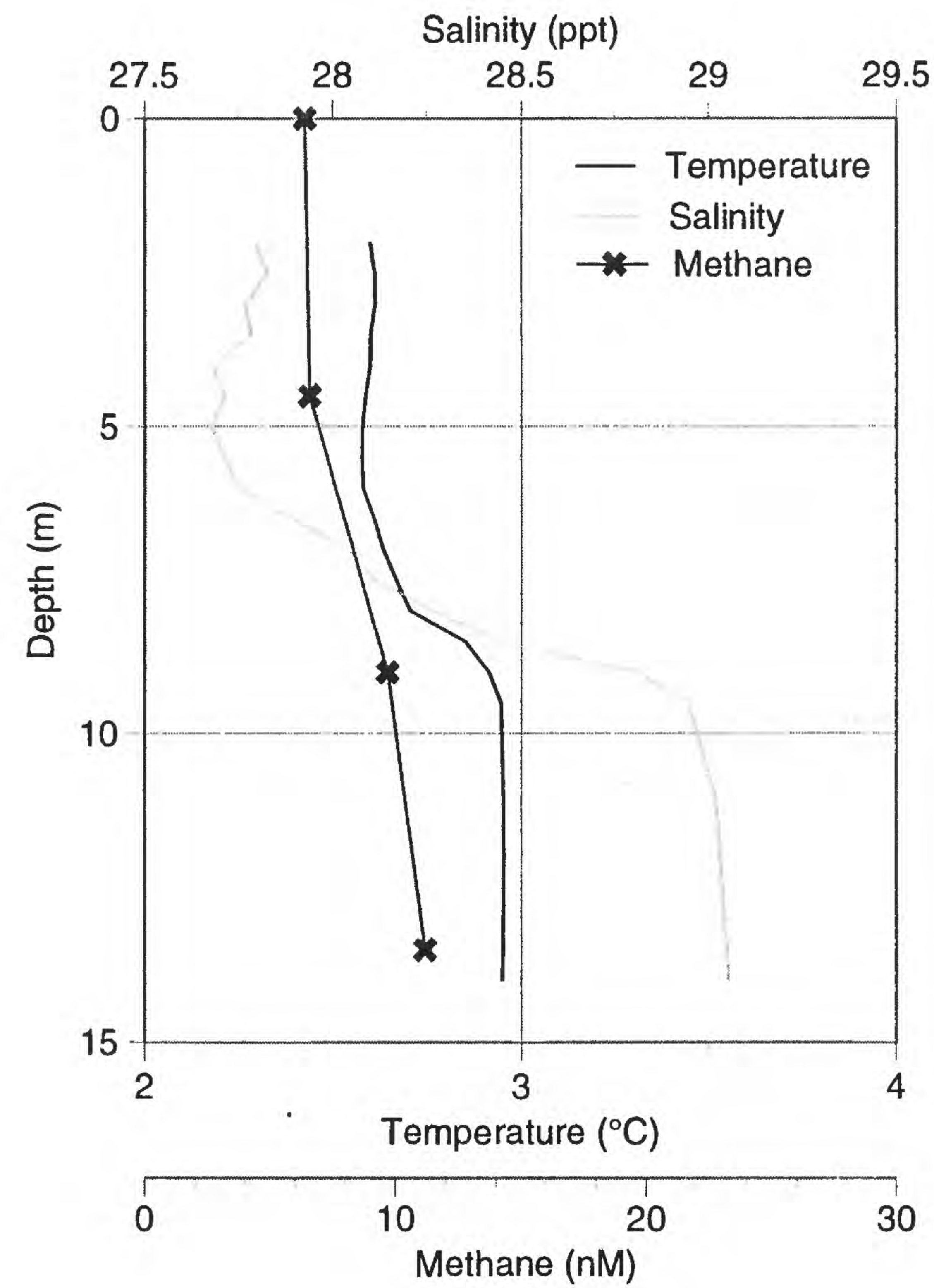


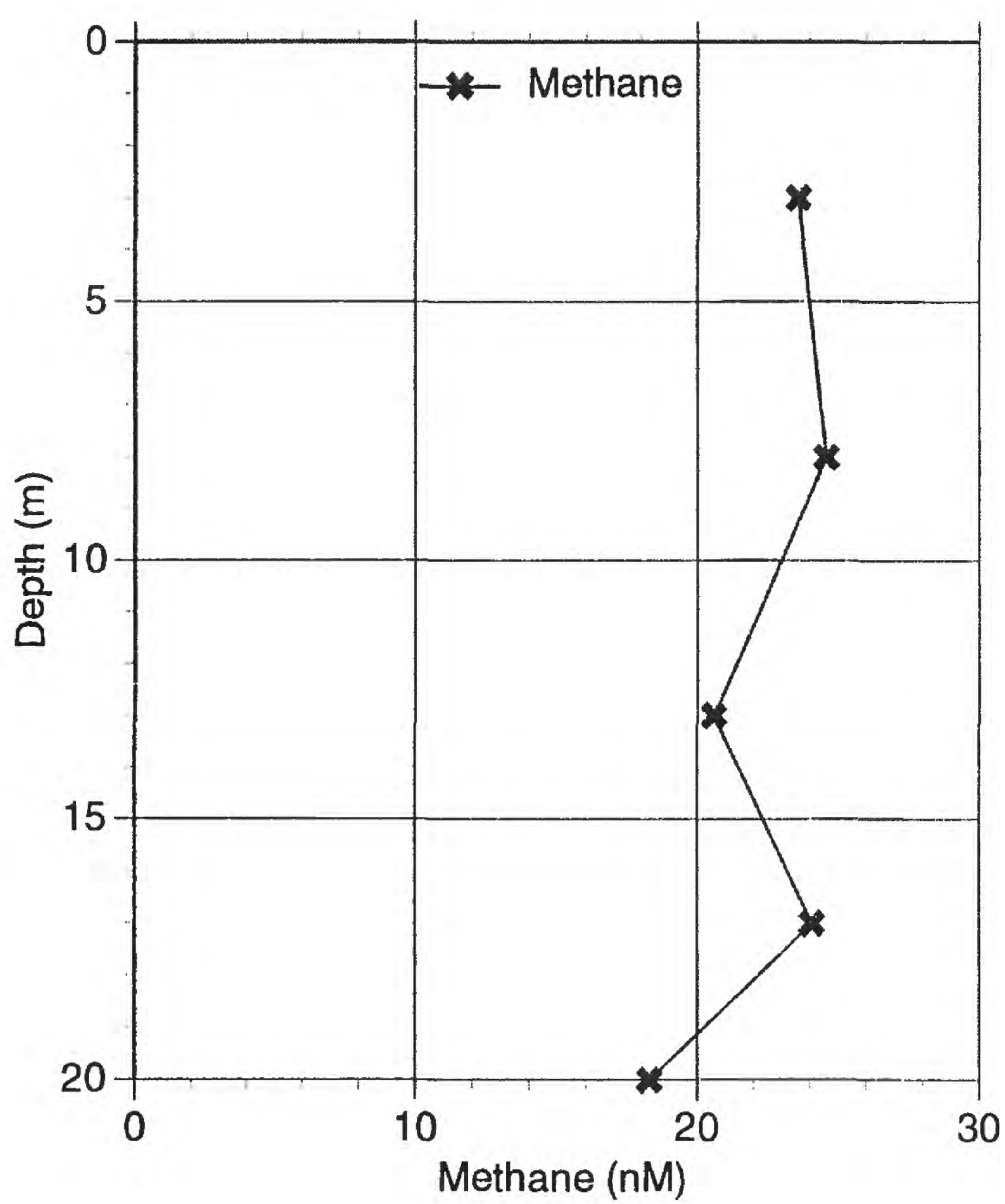
934215 T2 Colville River 15m April, 1993



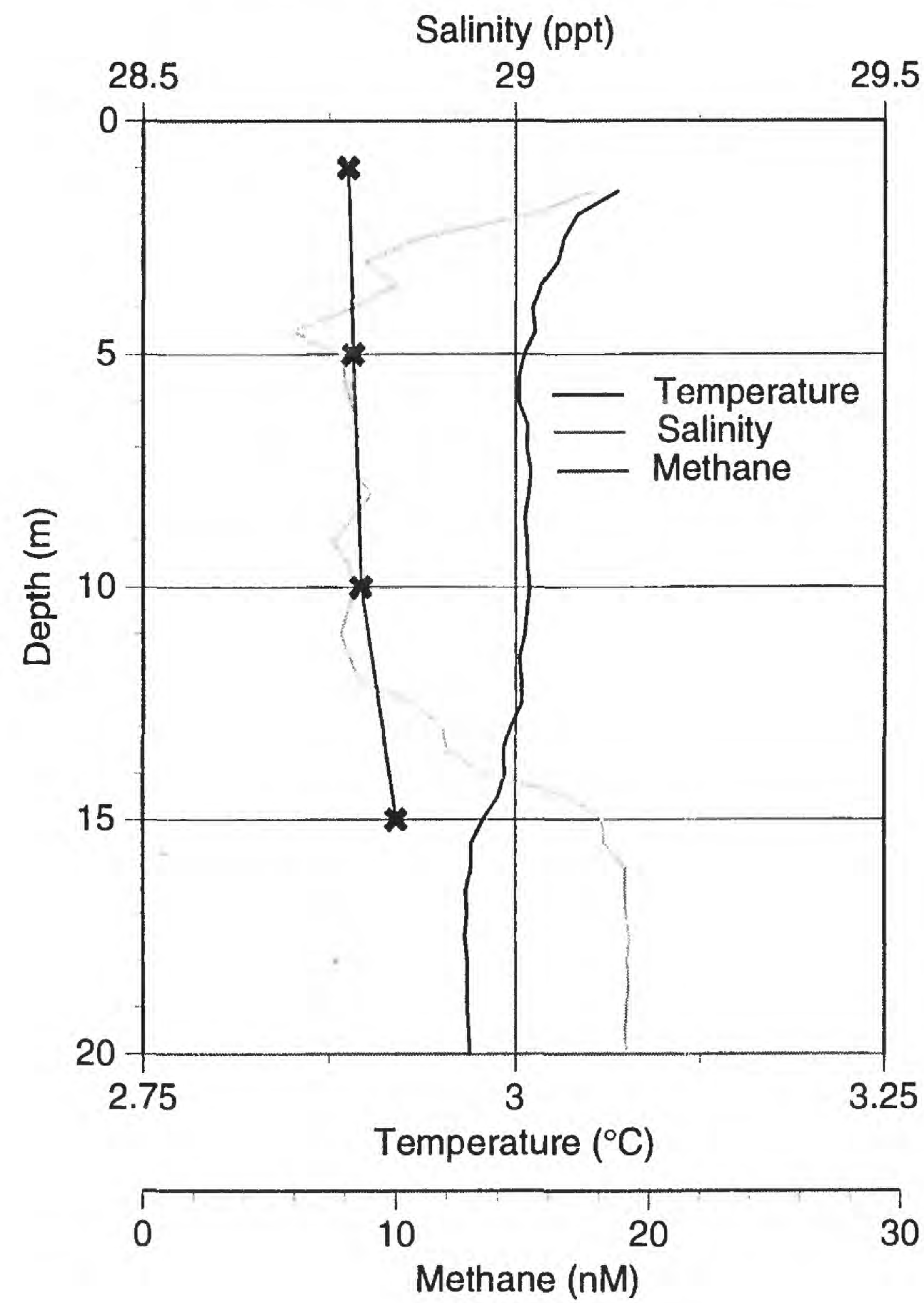
939212 T2 Colville River 12m Sept., 1993



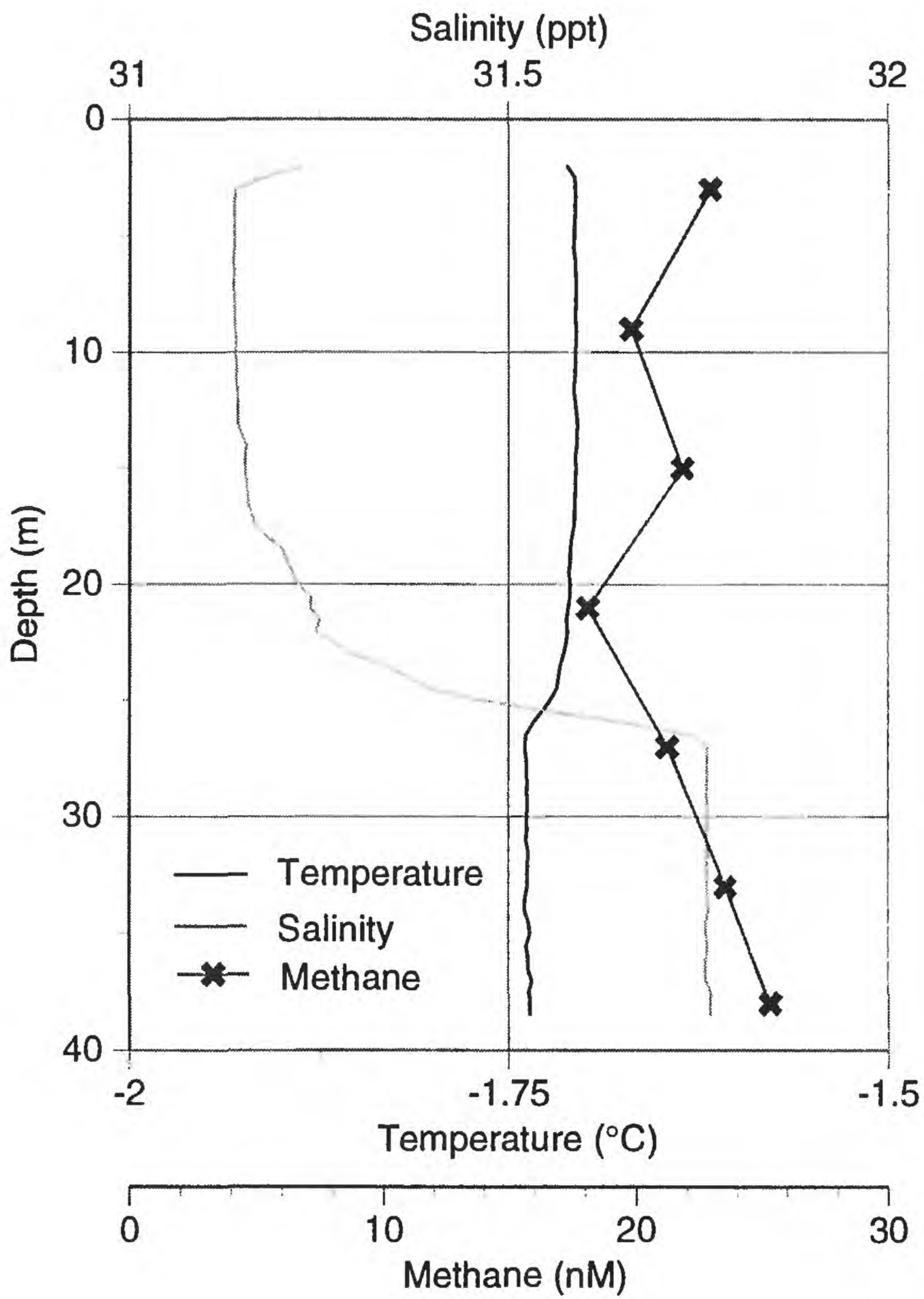
934220 T2 Colville R. 20m April, 1993



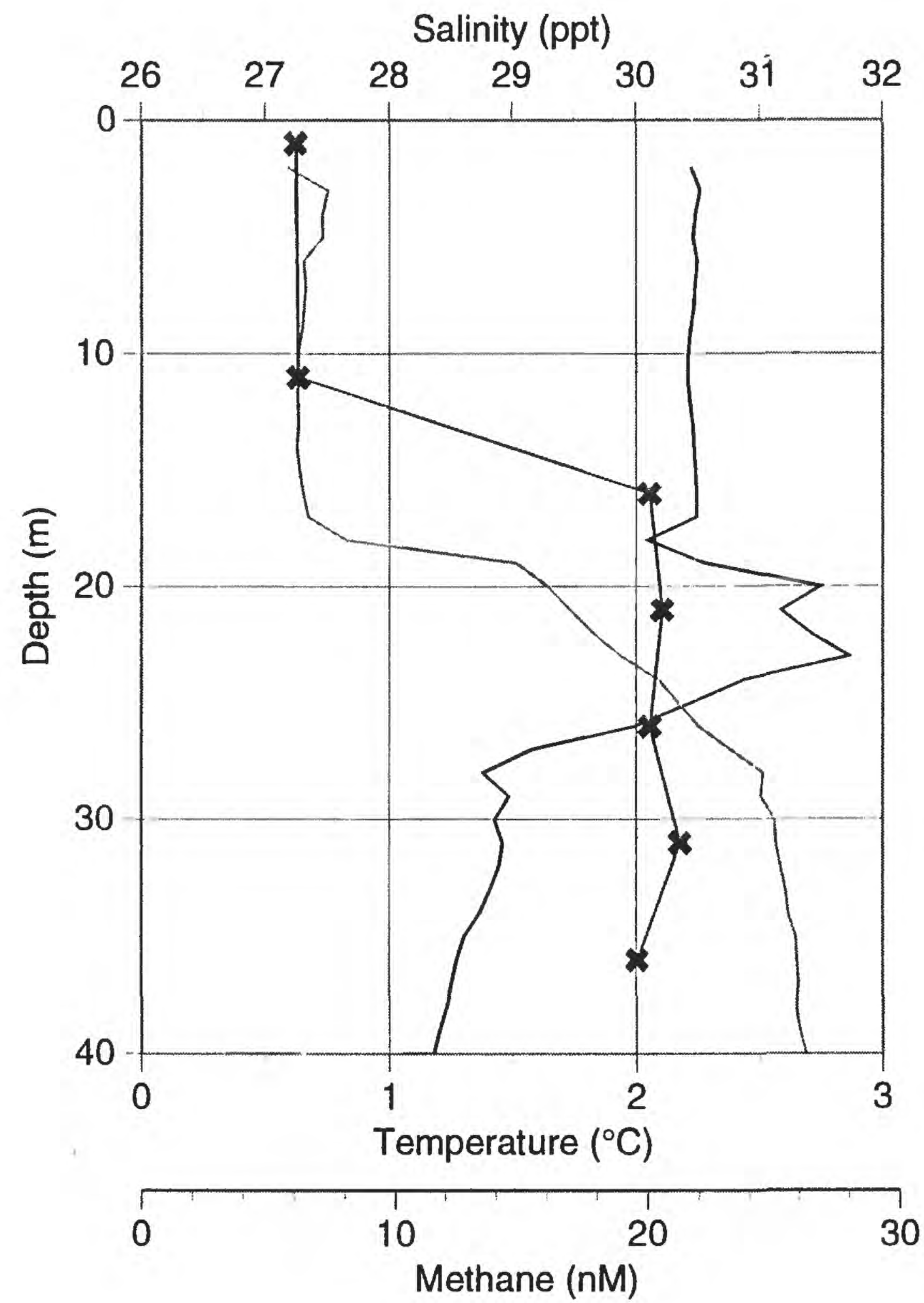
939220 T2 Colville R. 20m Sept., 1993



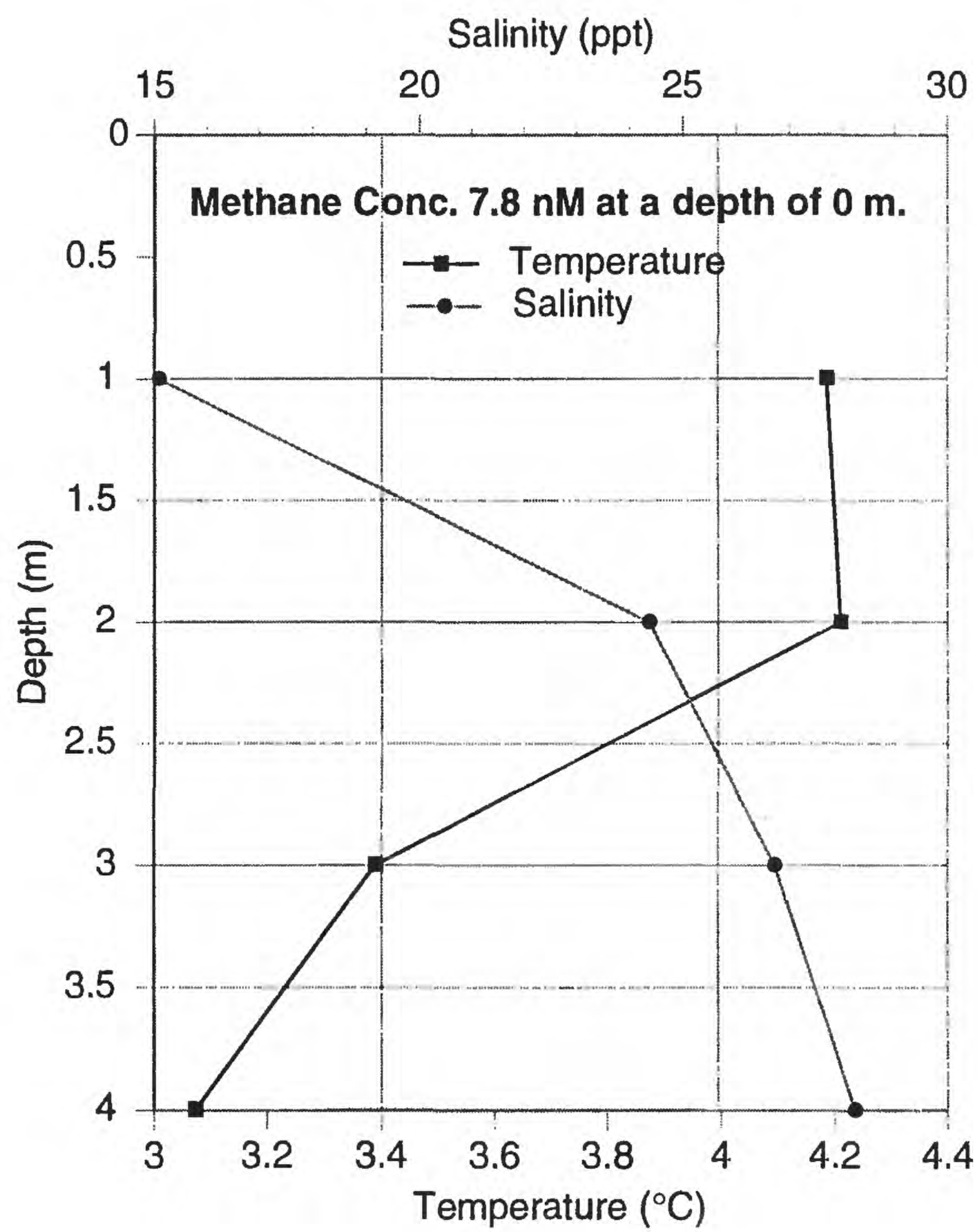
934240 T2 Colville R. 40m April, 1993



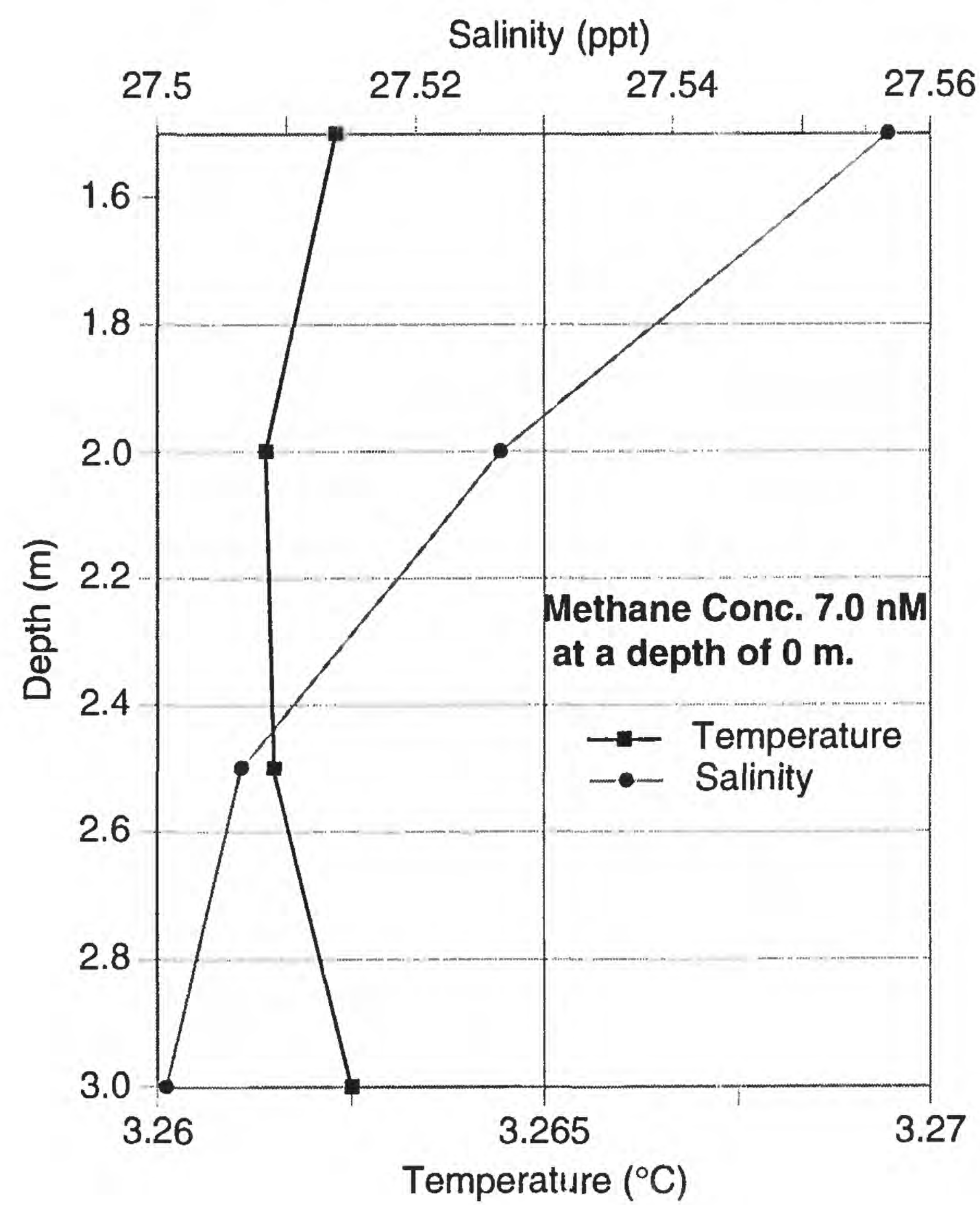
939240 T2 Colville R. 40m Sept., 1993



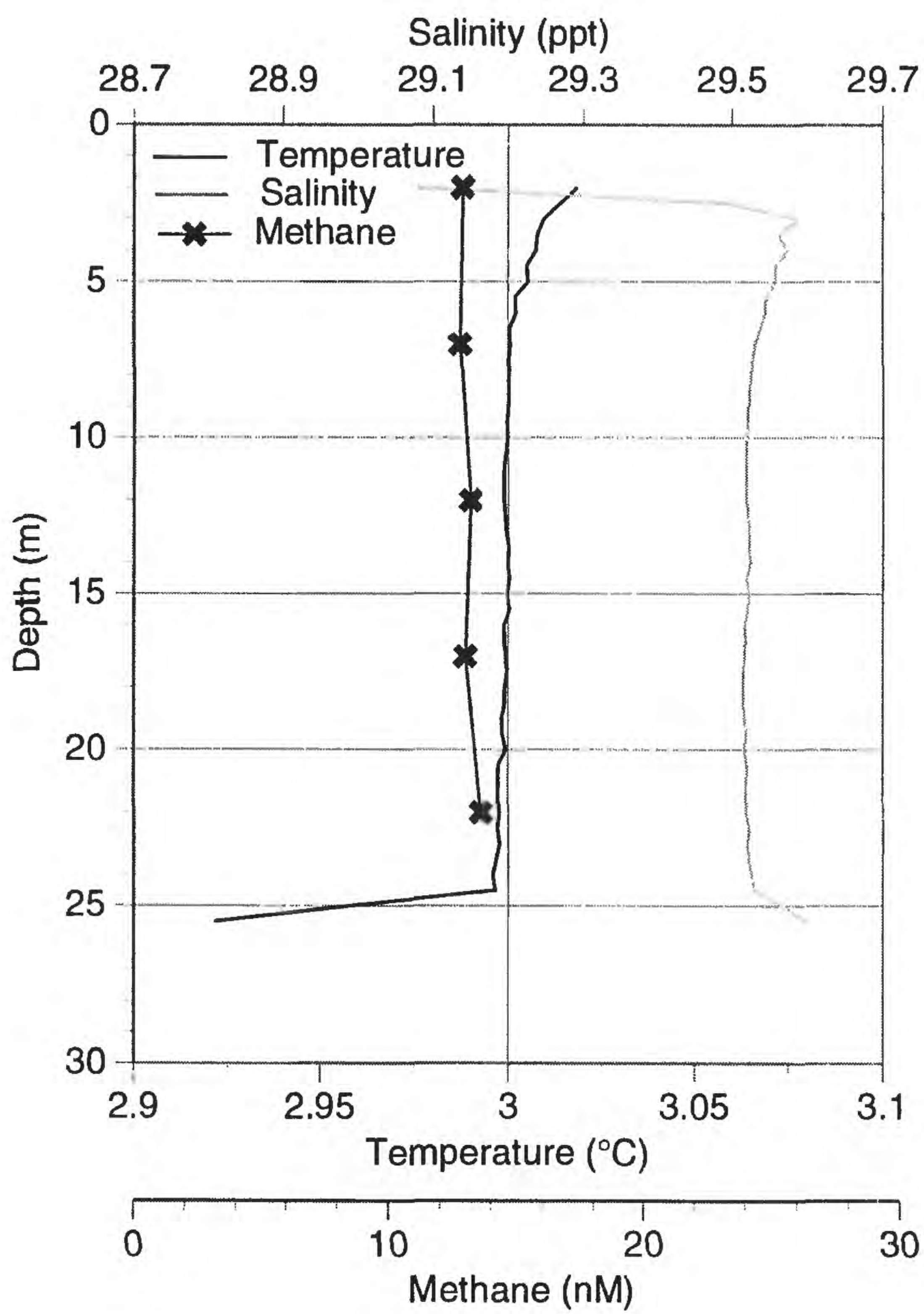
939103 T1 Oliktok 3m Sept., 1993



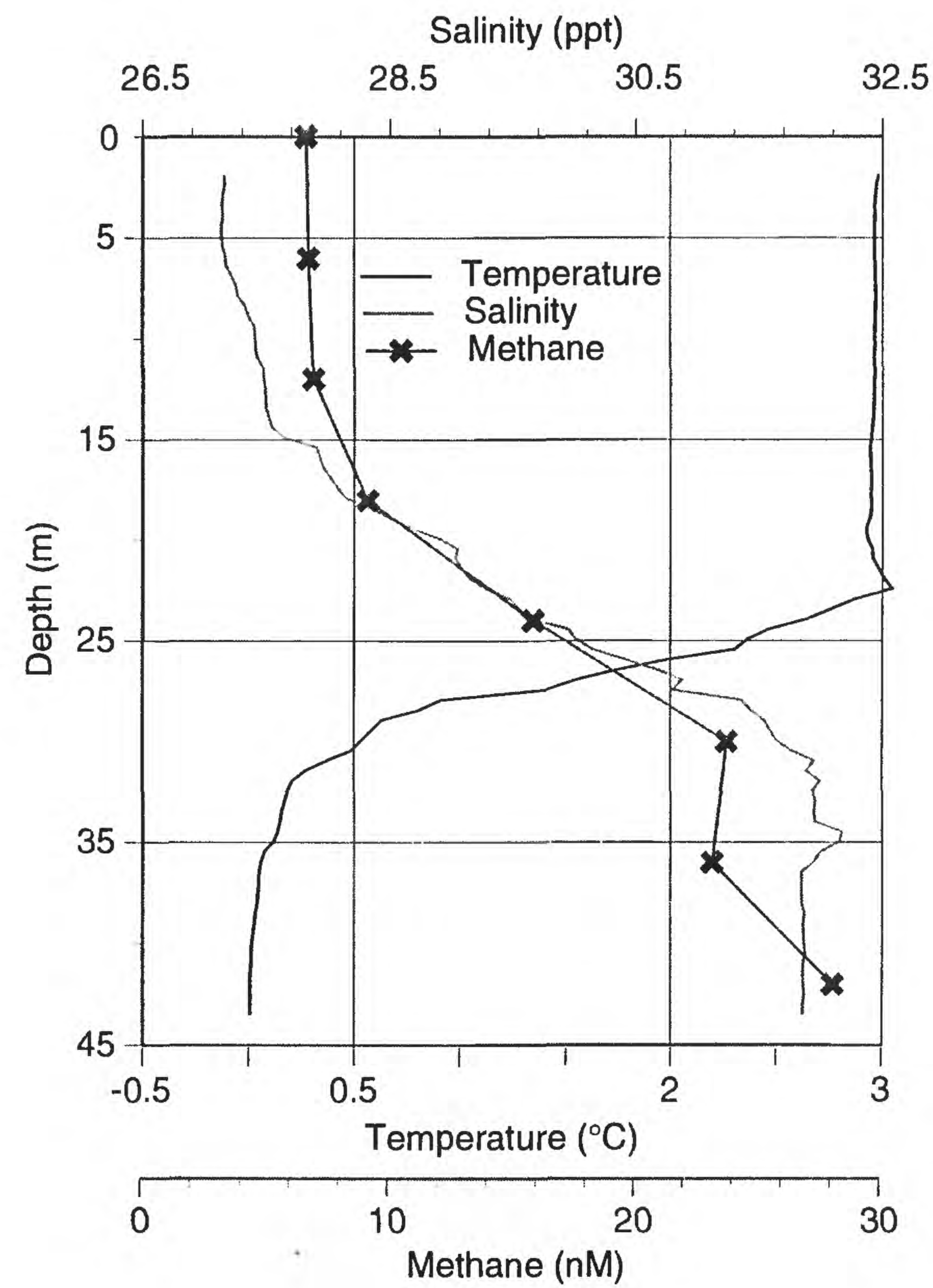
939402 T4 Kuparuk R. 2m Sept., 1993



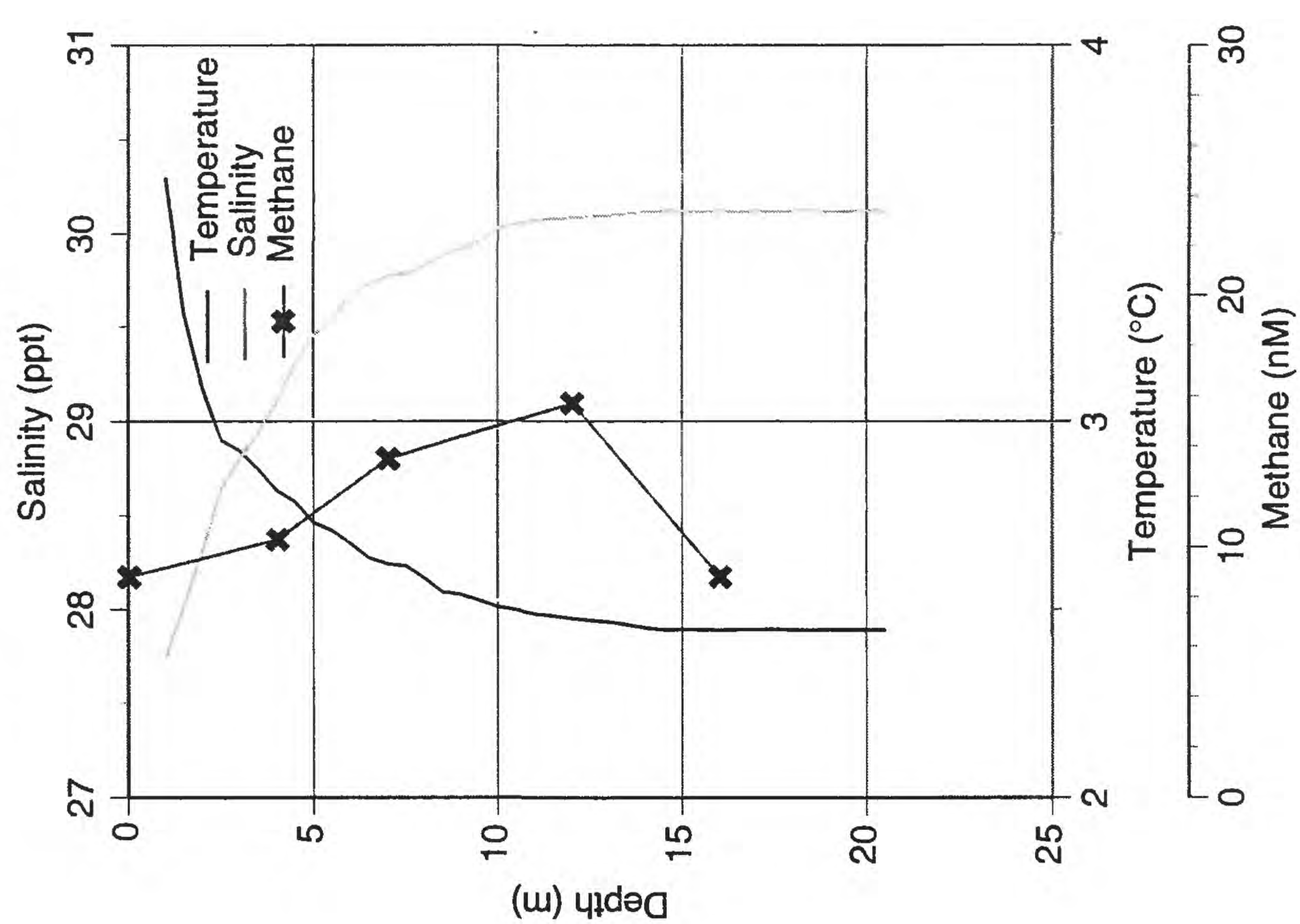
939125 T1 Oilktok Pt. 25m Sept., 1993



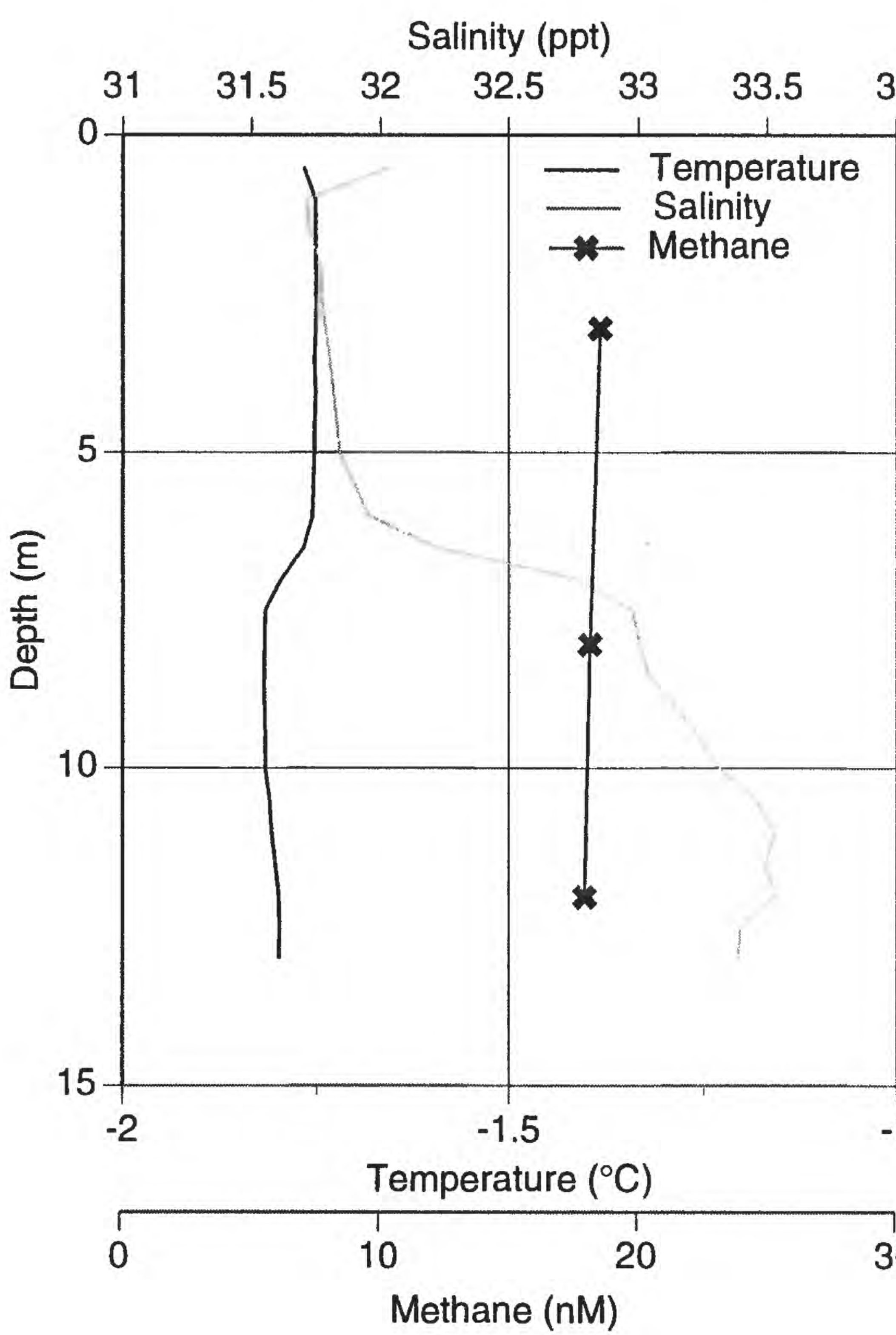
939140 T1 Oilktok Pt. 40m Sept., 1993



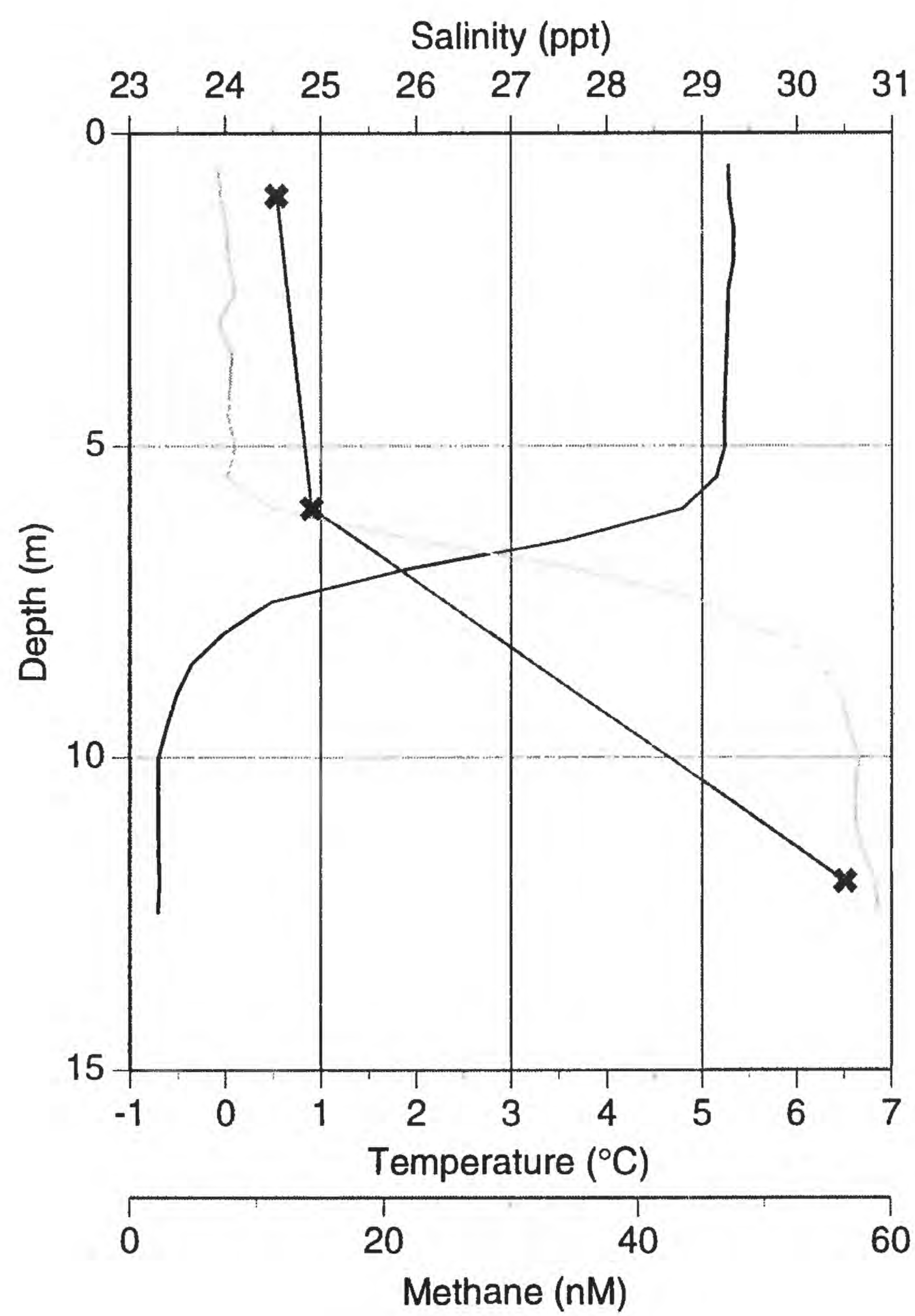
939420 T4 Kuparuk R. 20m Sept., 1993



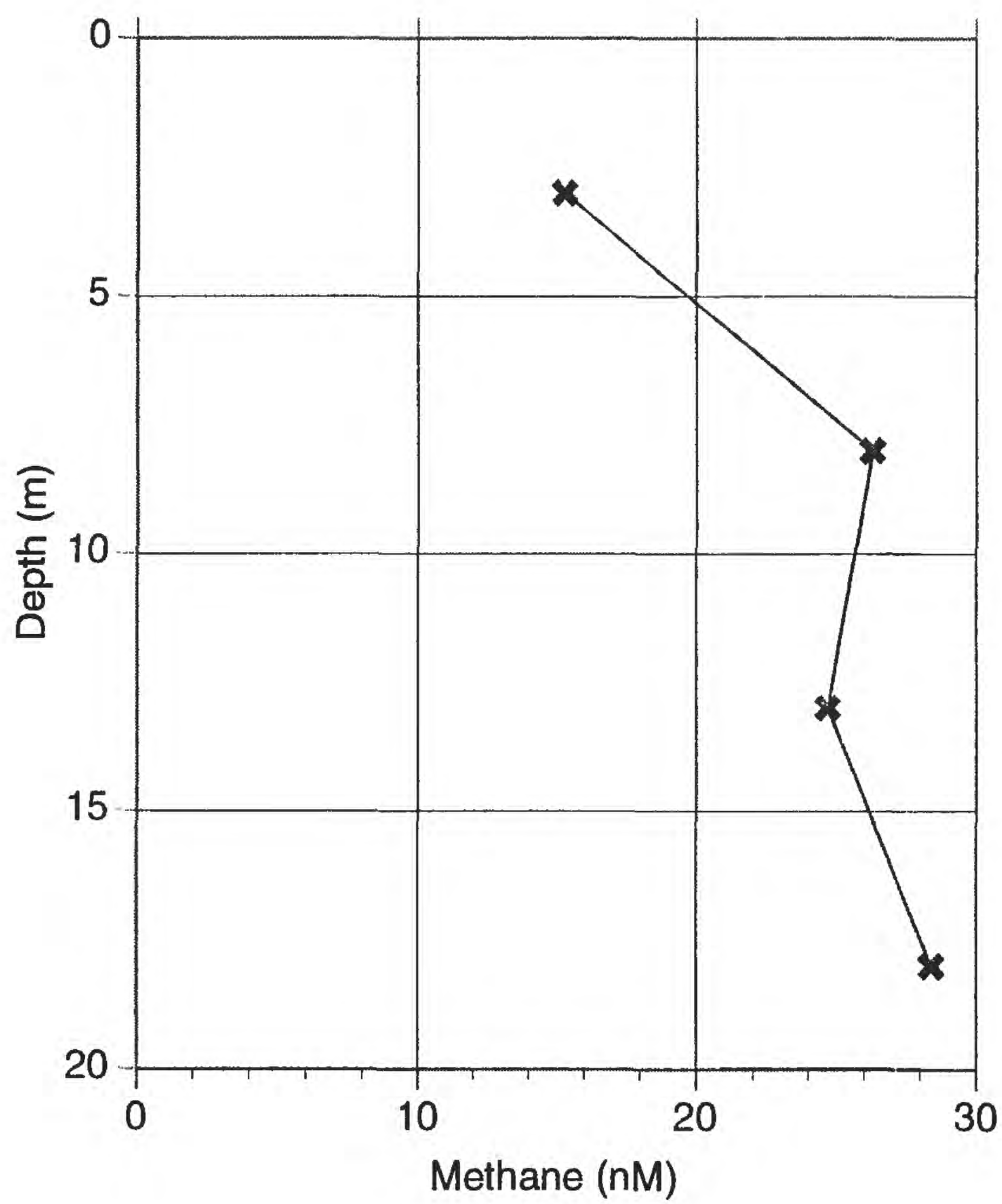
944114 T1 Oliktok Pt., 14m April 1994



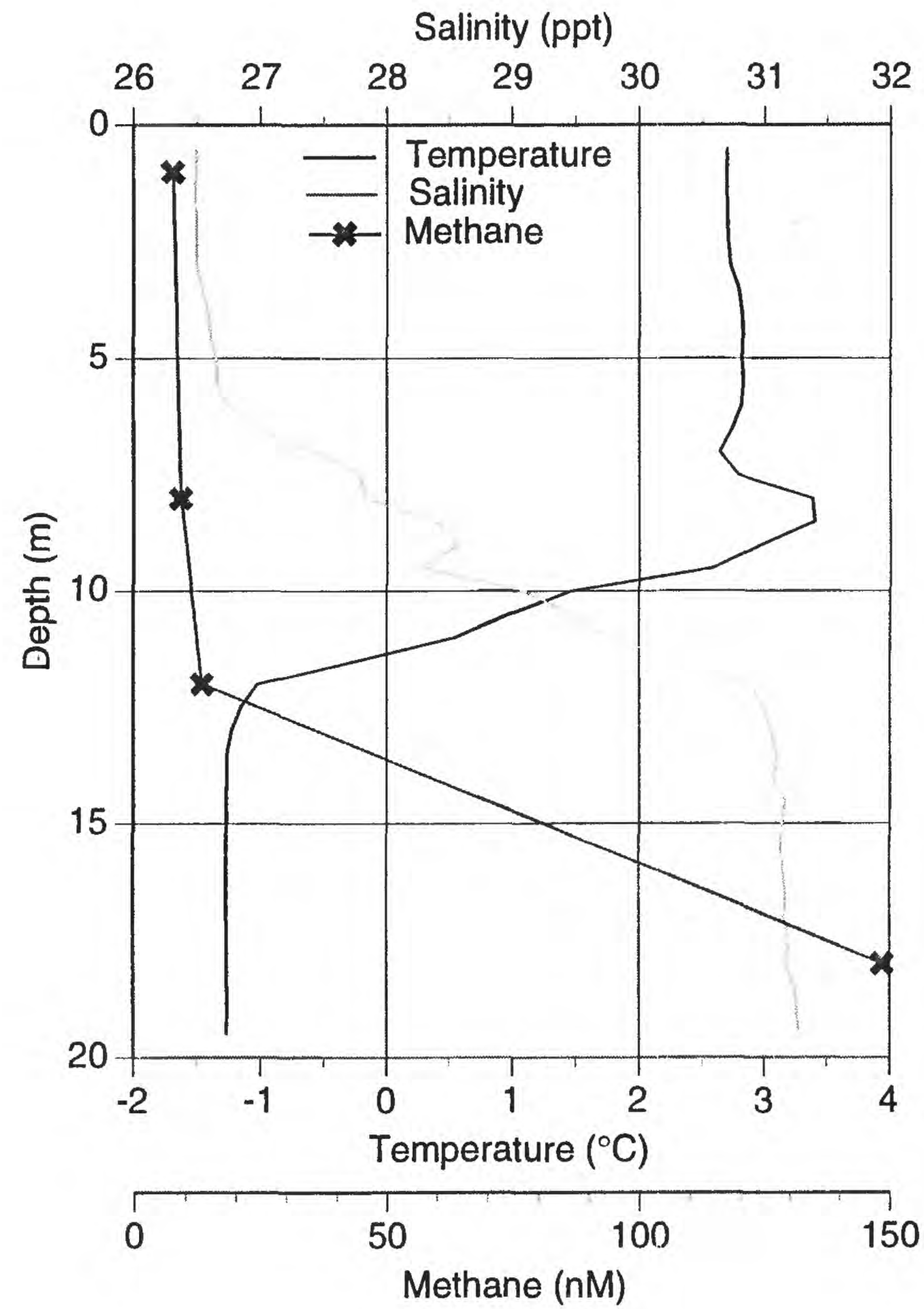
948114 T1 Oliktok Pt., 14m August 1994



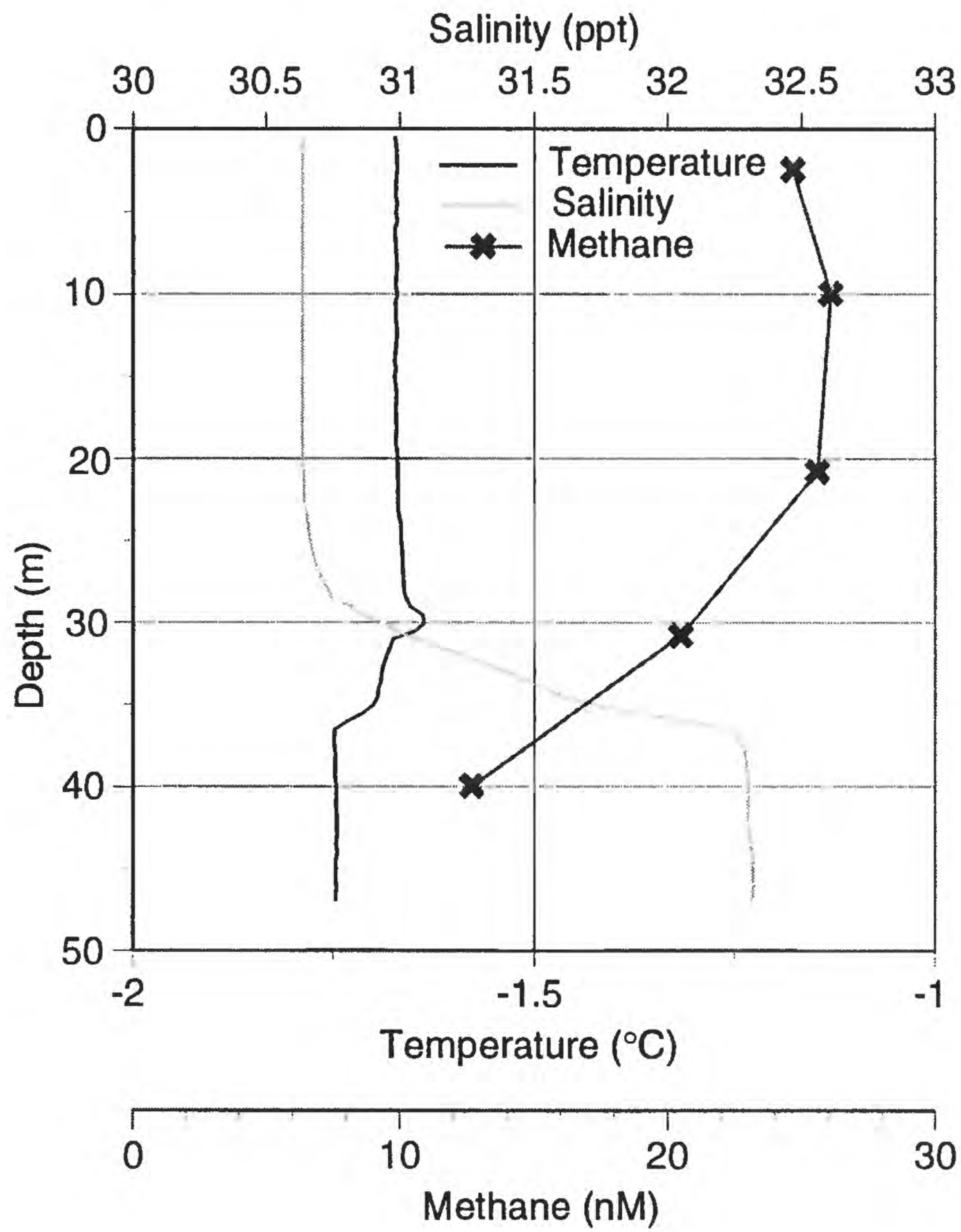
944120 T1 Oliktok Pt. 20m April, 1994



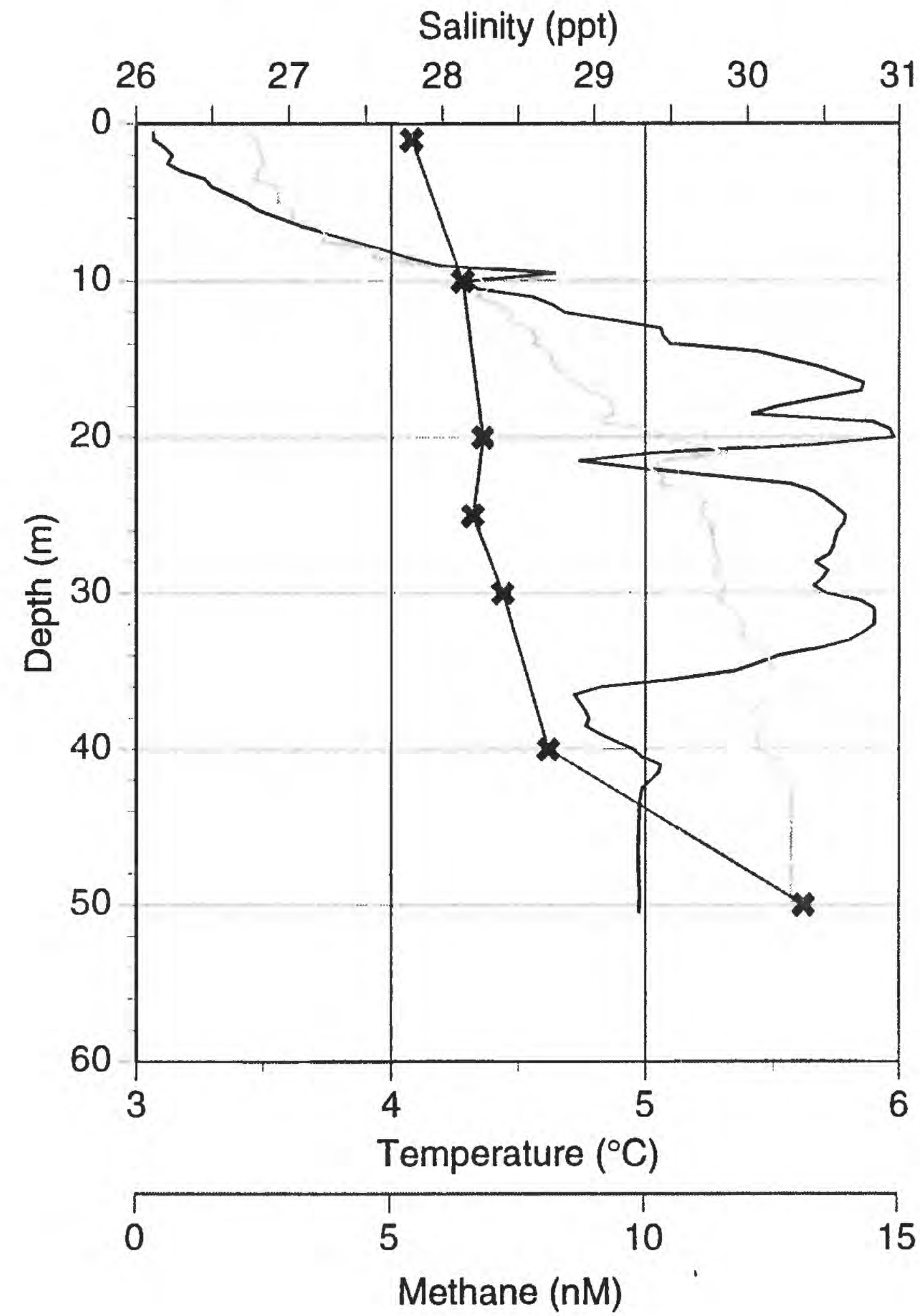
948120 T1 Oliktok Pt. 20m August, 1994

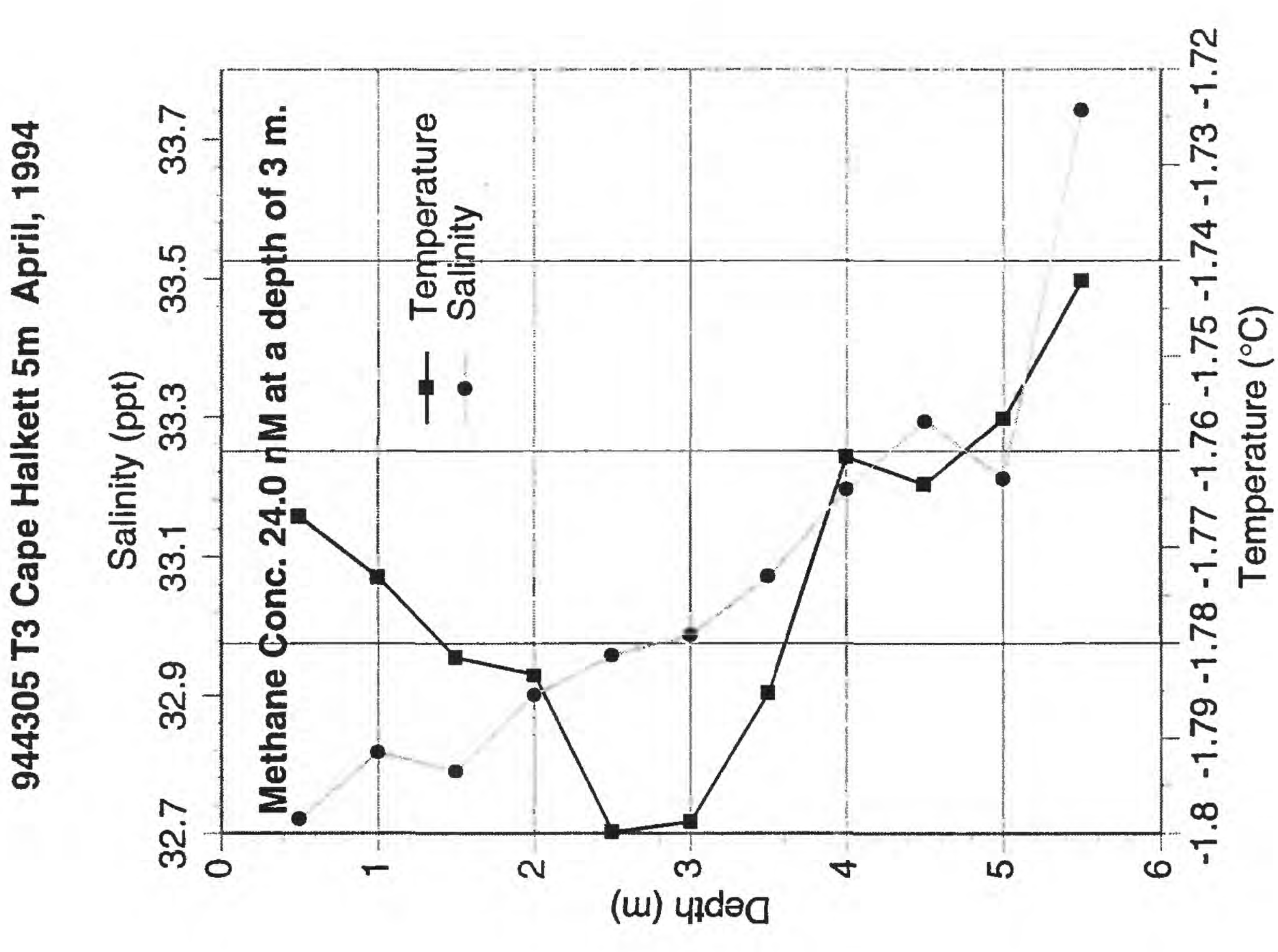


944150 T1 Oliktok Pt. 50m   April 1994

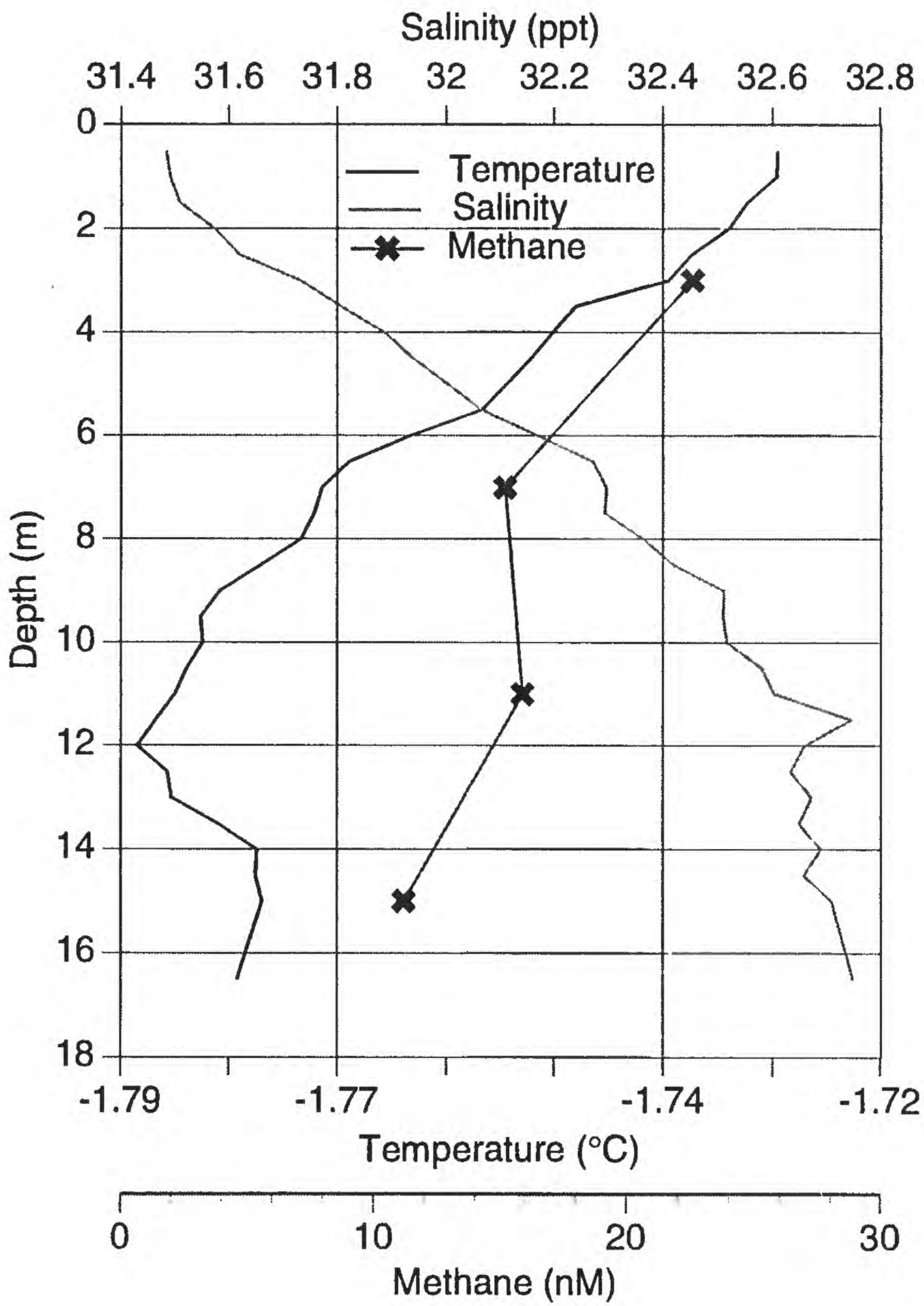


948150 T1 Oliktok Pt. 50m   August 1994

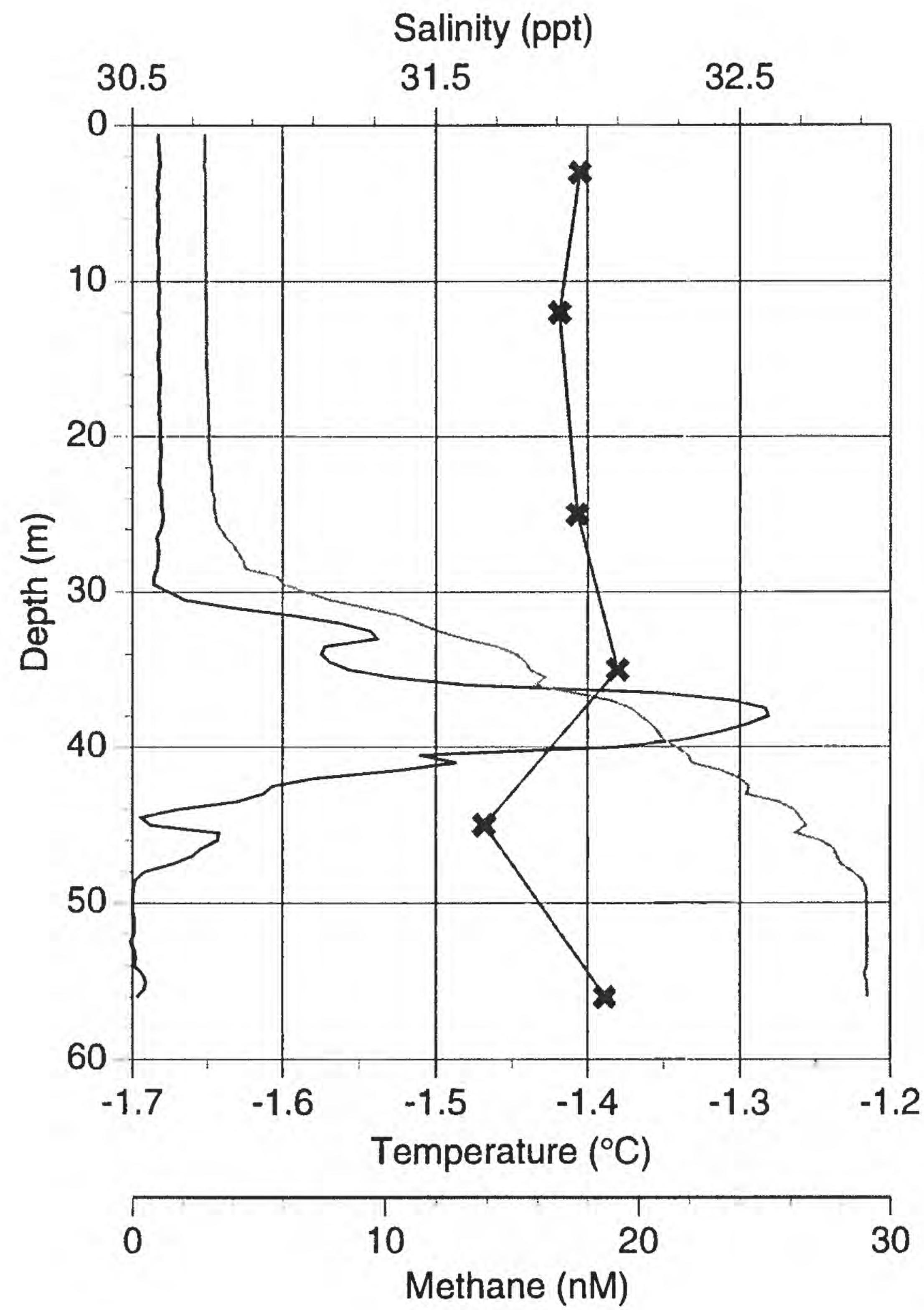



944305 T3 Cape Halkett 5m April, 1994
Methane Conc. 24.0 nM at a depth of 3 m.
Salinity (ppt)
32.7
32.9
33.1
33.3
33.5
33.7
Temperature
Salinity
Depth (m)
0
1
2
3
4
5
6
Temperature (°C)
-1.8 -1.79 -1.78 -1.77 -1.76 -1.75 -1.74 -1.73 -1.72

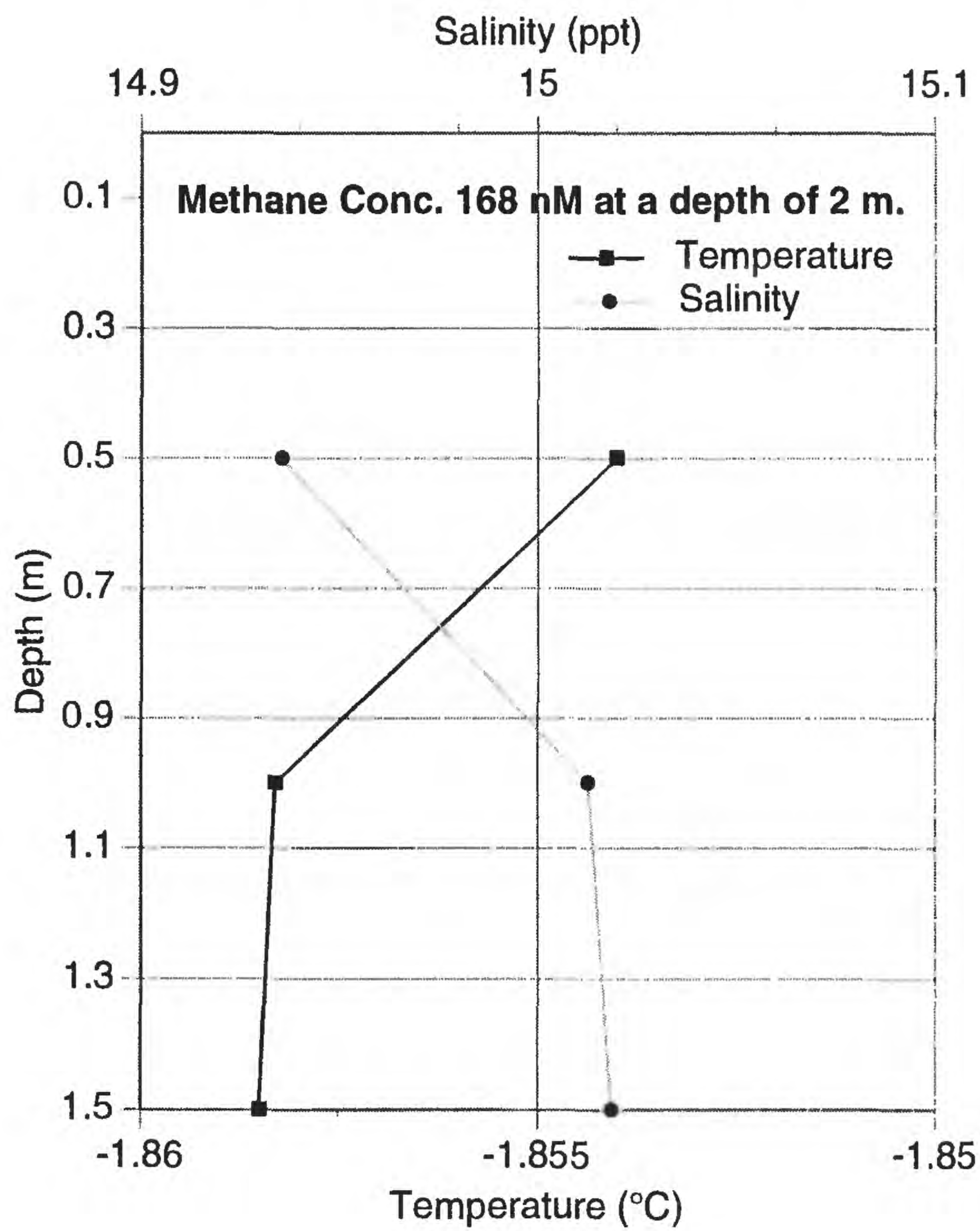
944320 T3 Cape Halkett 20m April, 1994



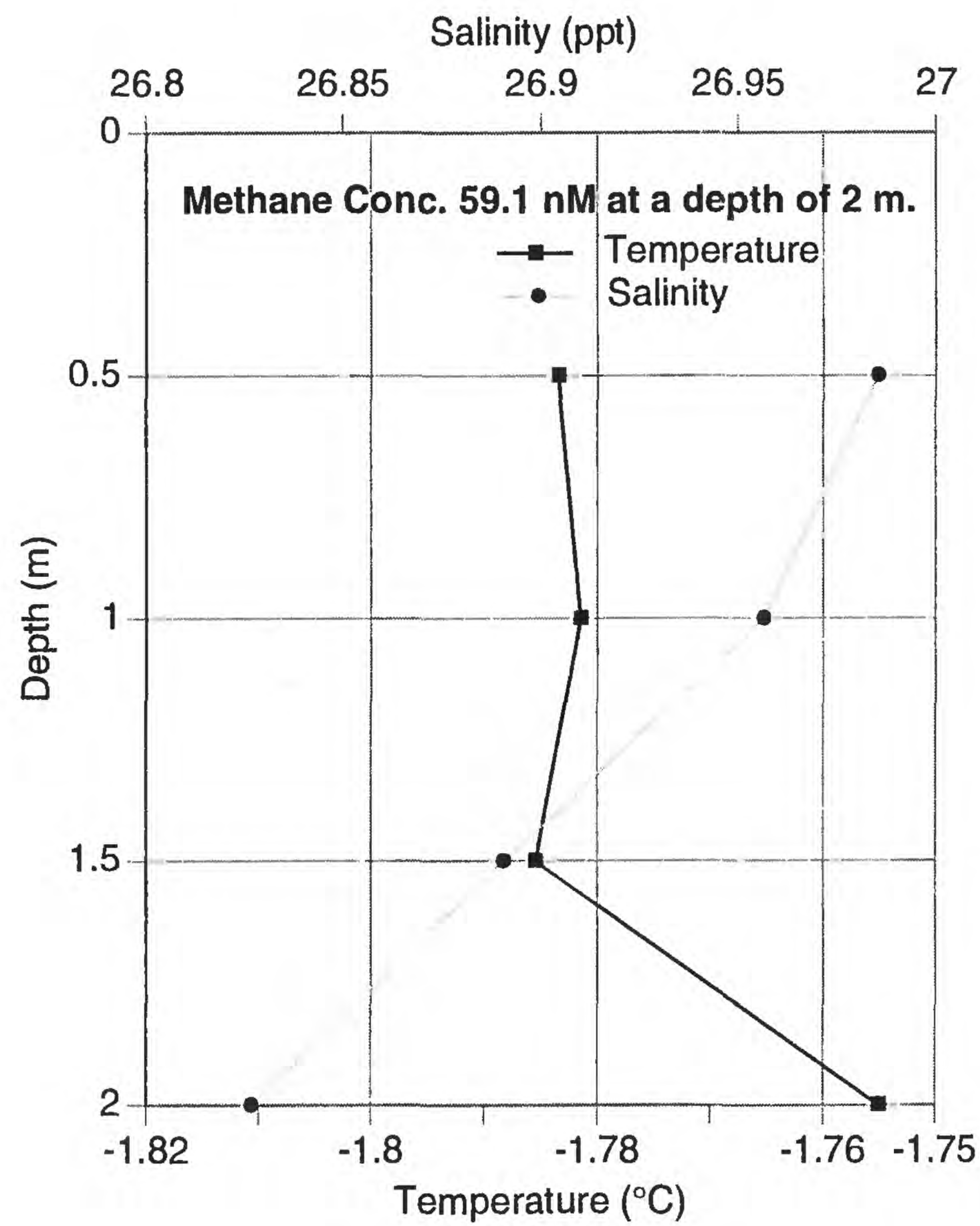
944350 T3 Cape Halkett 50m April, 1994

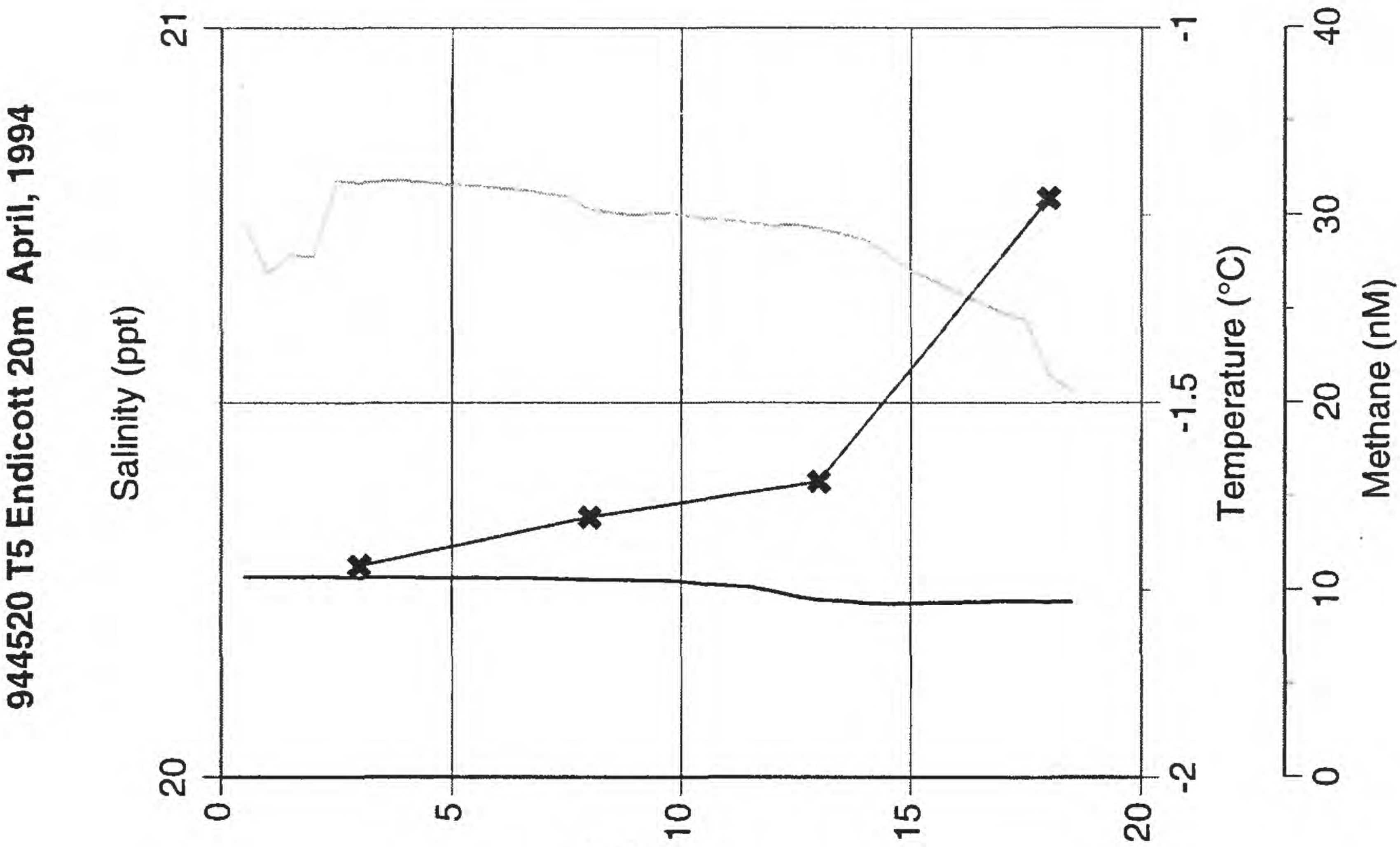


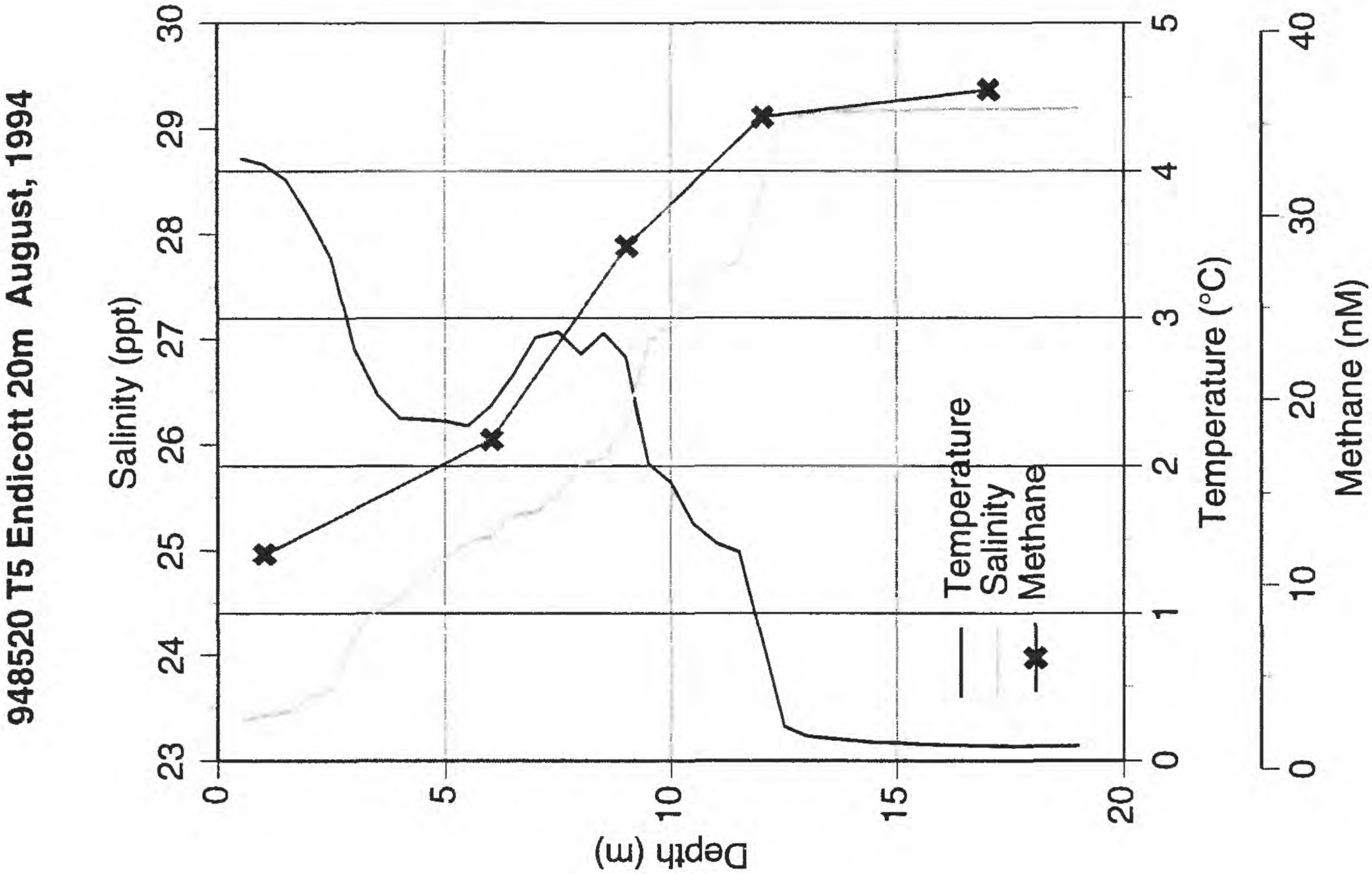
9944502 T2 Endicott 2m April, 1994



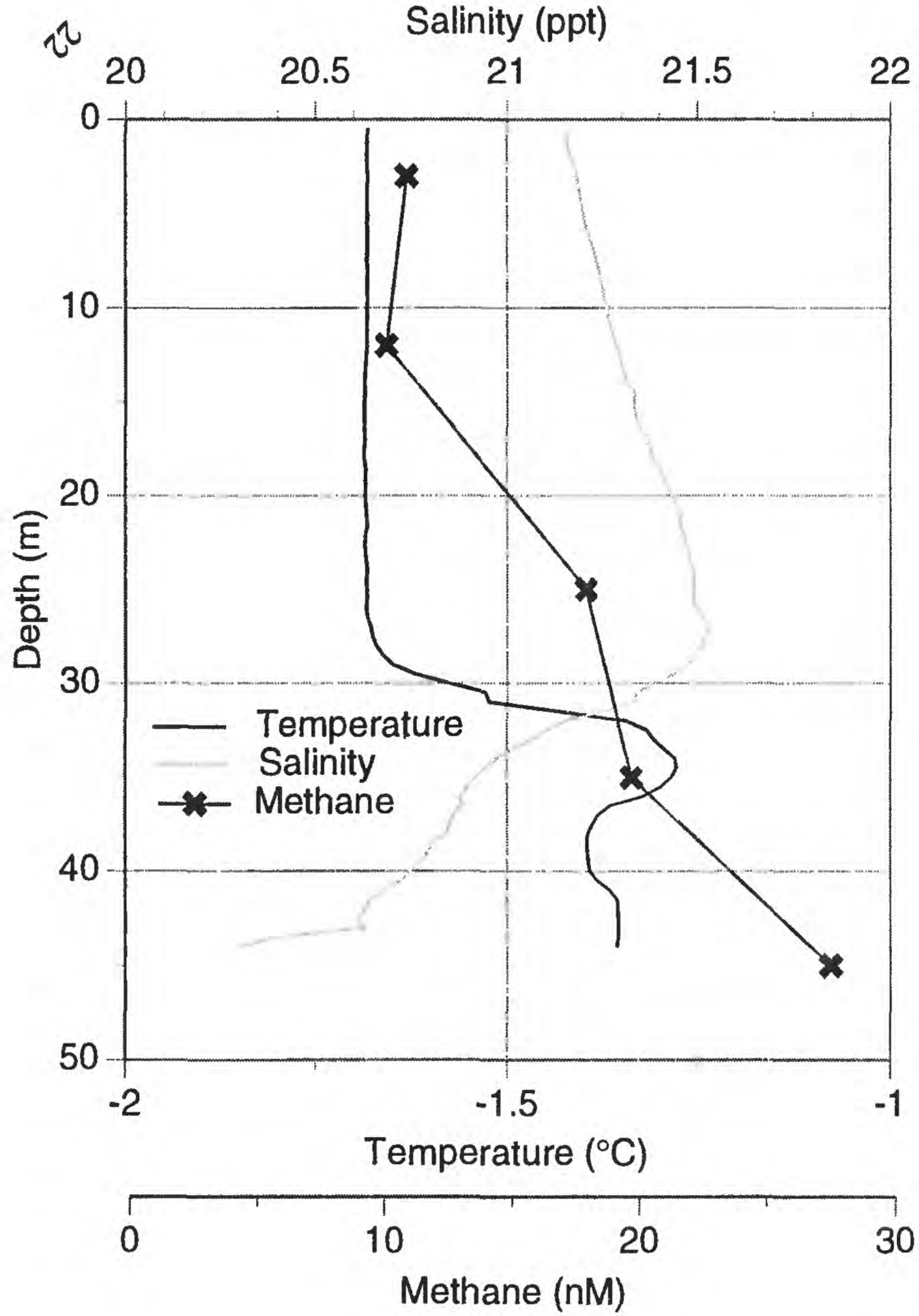
944505 T5 Endicott 5m April, 1994



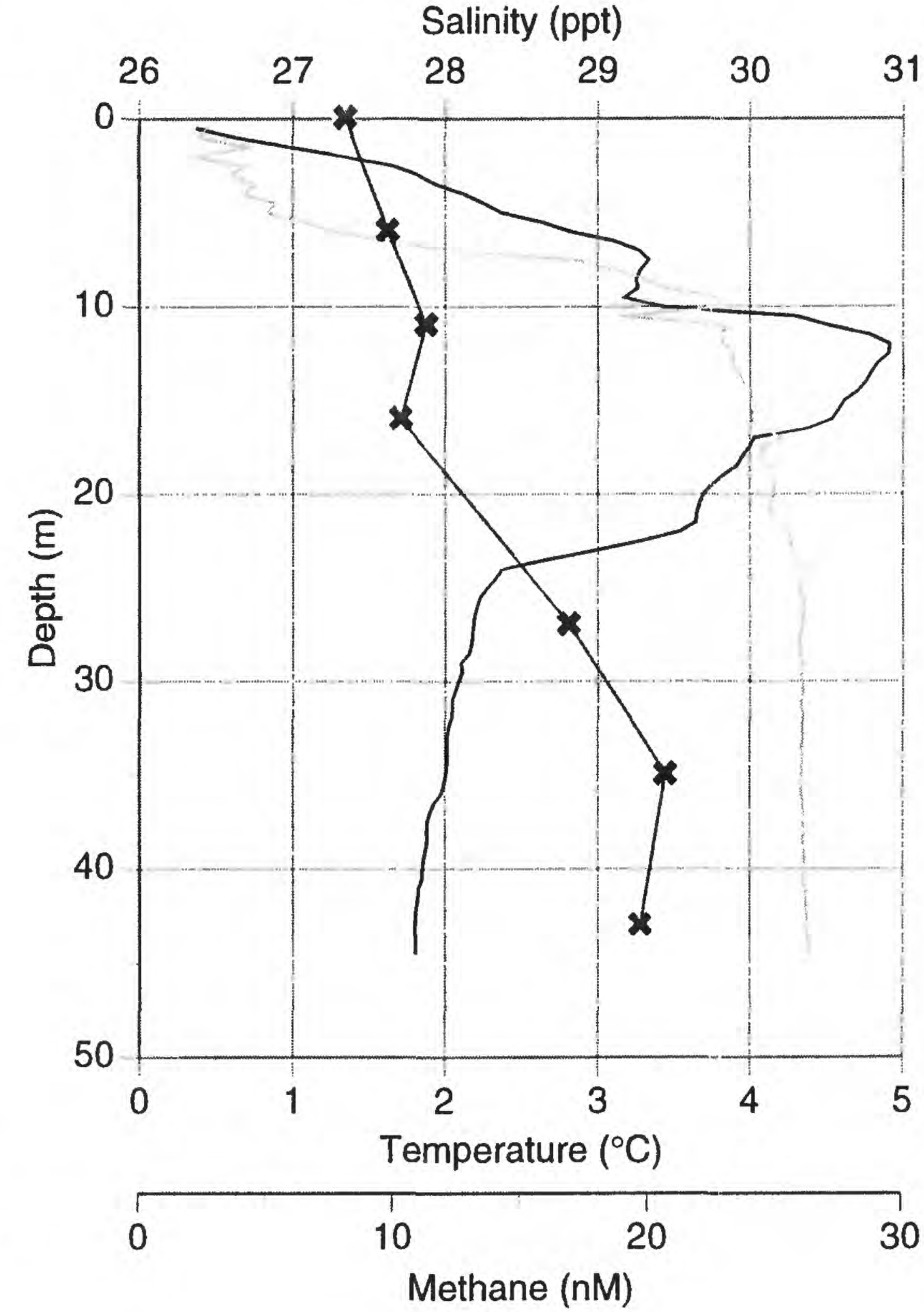

944520 T5 Endicott 20m April, 1994
Salinity (ppt)
20
21
Depth (m)
0
5
10
15
20
Temperature (°C)
-2
-1.5
-1
Methane (nM)
0
10
20
30
40


948520 T5 Endicott 20m August, 1994
Salinity (ppt)
23
24
25
26
27
28
29
30
Depth (m)
0
5
10
15
20
Temperature (°C)
0
1
2
3
4
5
Methane (nM)
0
10
20
30
40
Temperature
Salinity
Methane

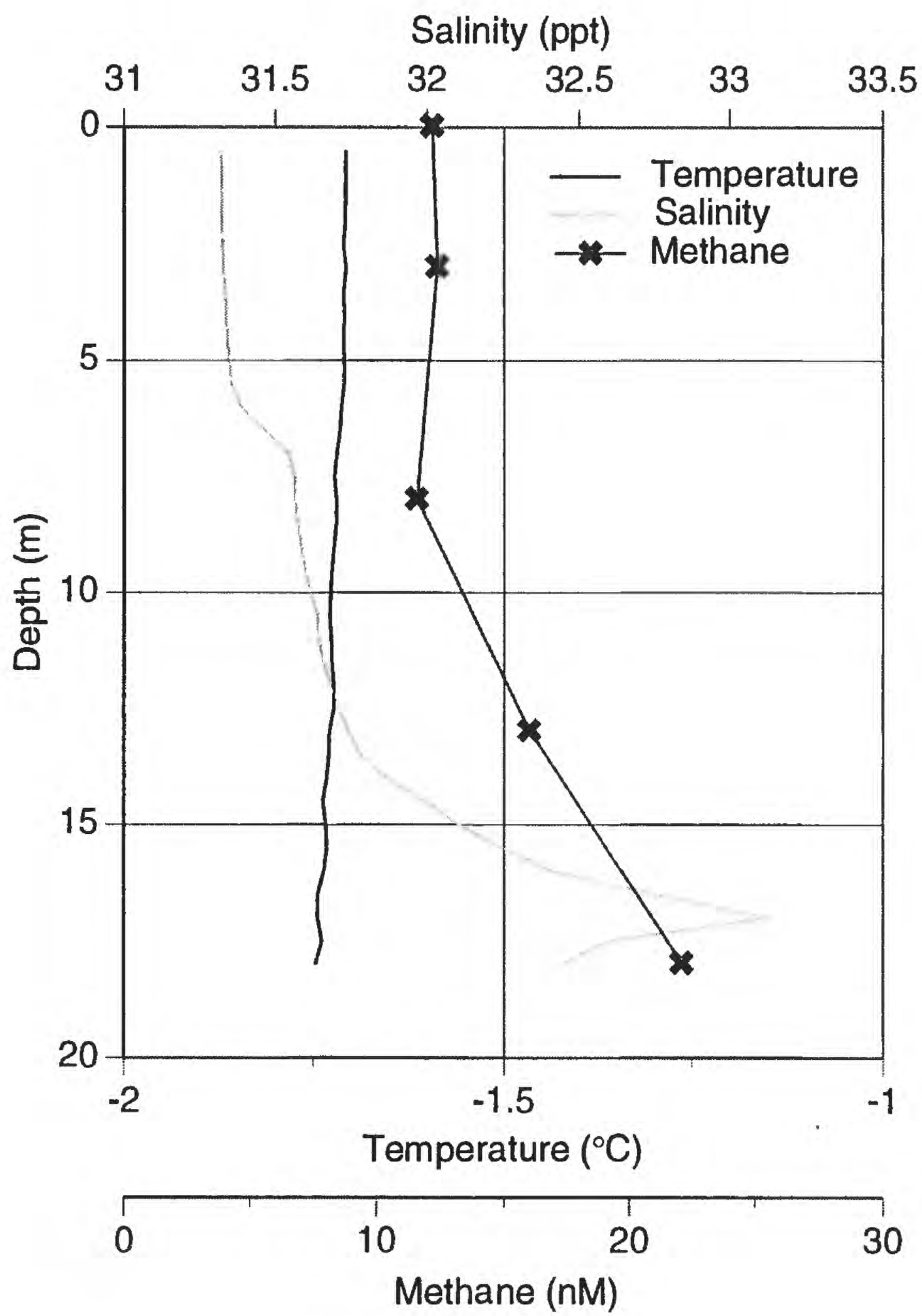
944550 T5 Endicott 50m April, 1994



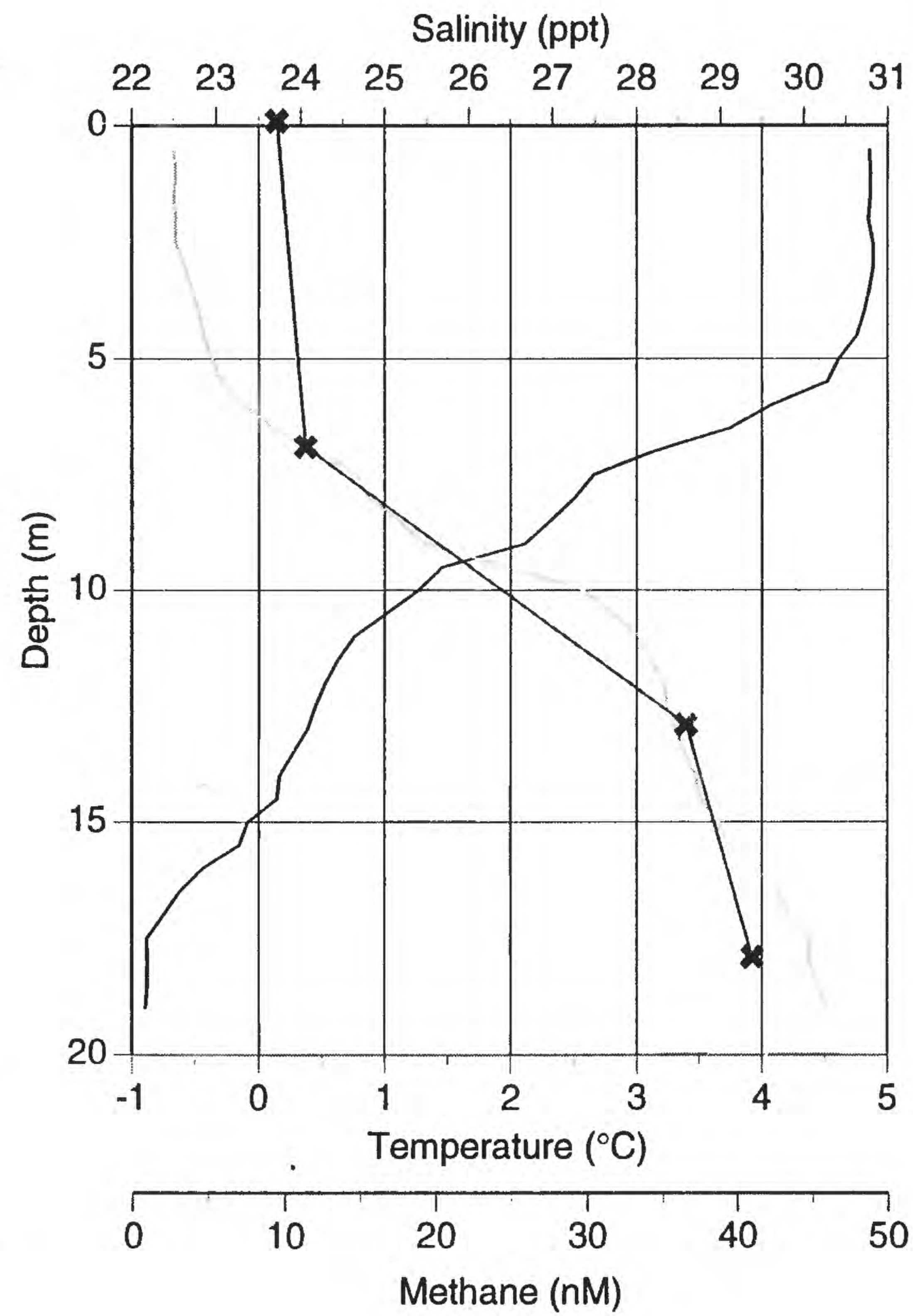
948545 T5 Endicott 45m August, 1994



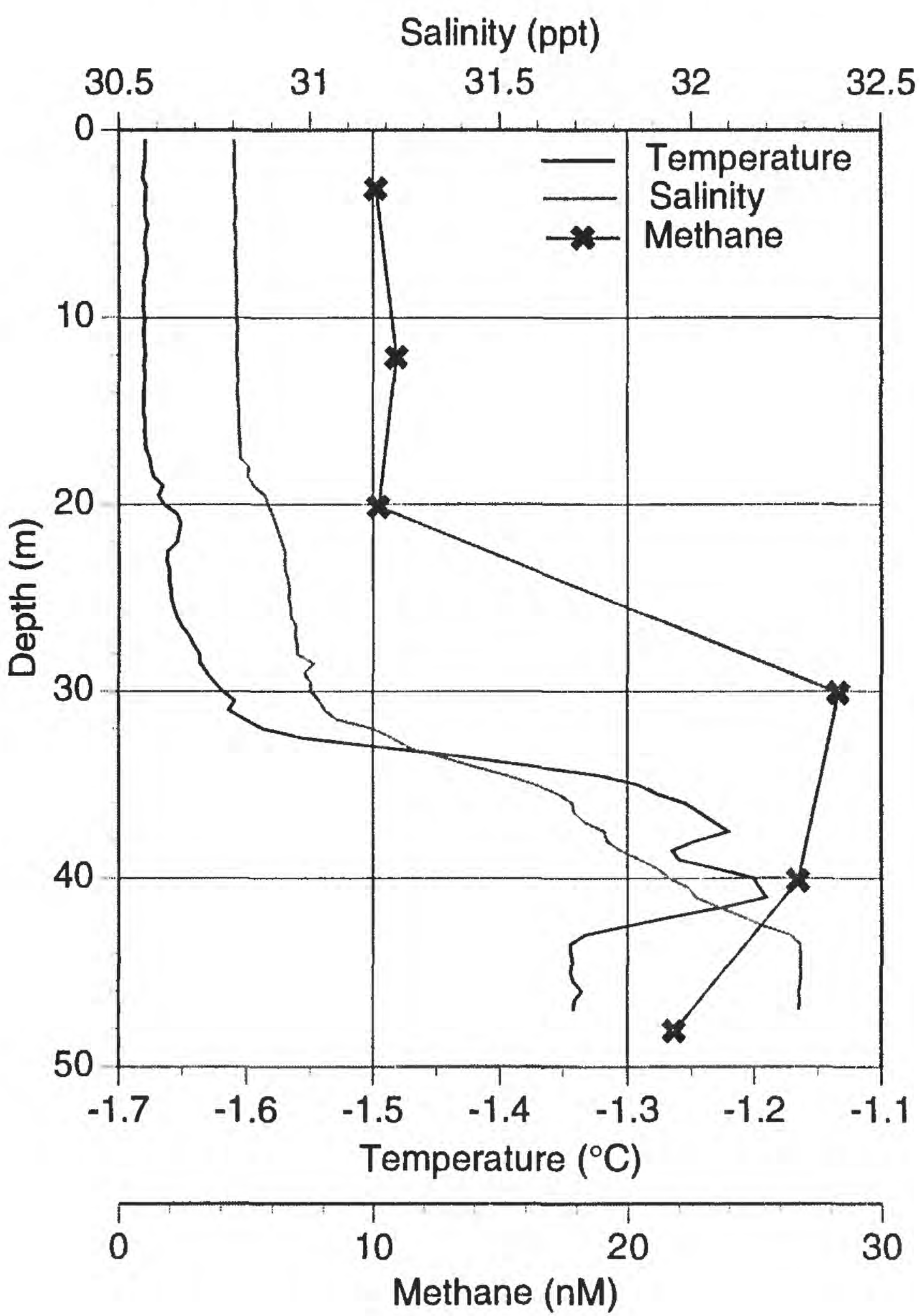
944620 T6 Mikkelsen Bay 20m April, 1994



948620 T6 Mikkelsen Bay 20m August, 1994

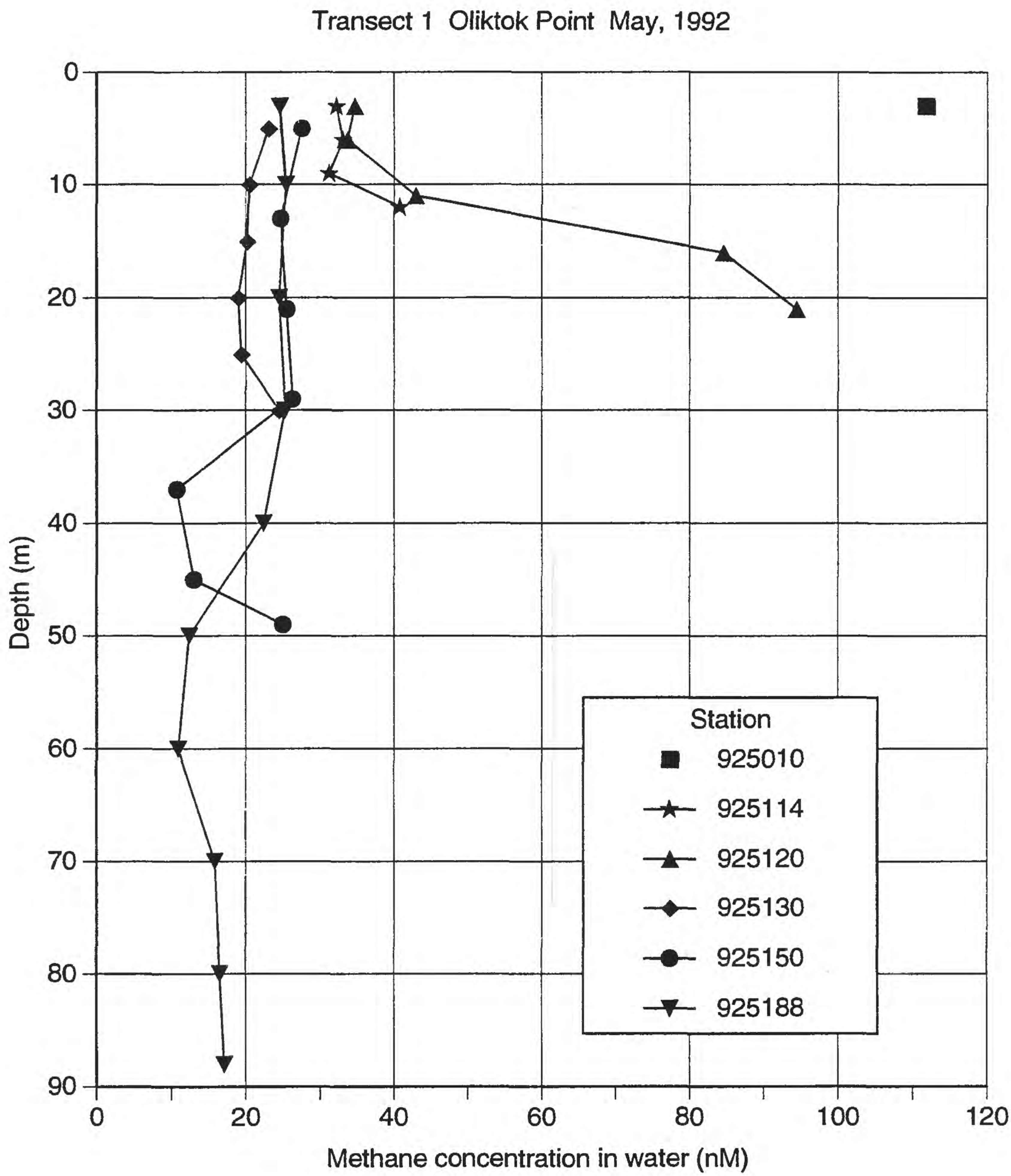


944650 T6 Mikkelsen Bay 50m April, 1994

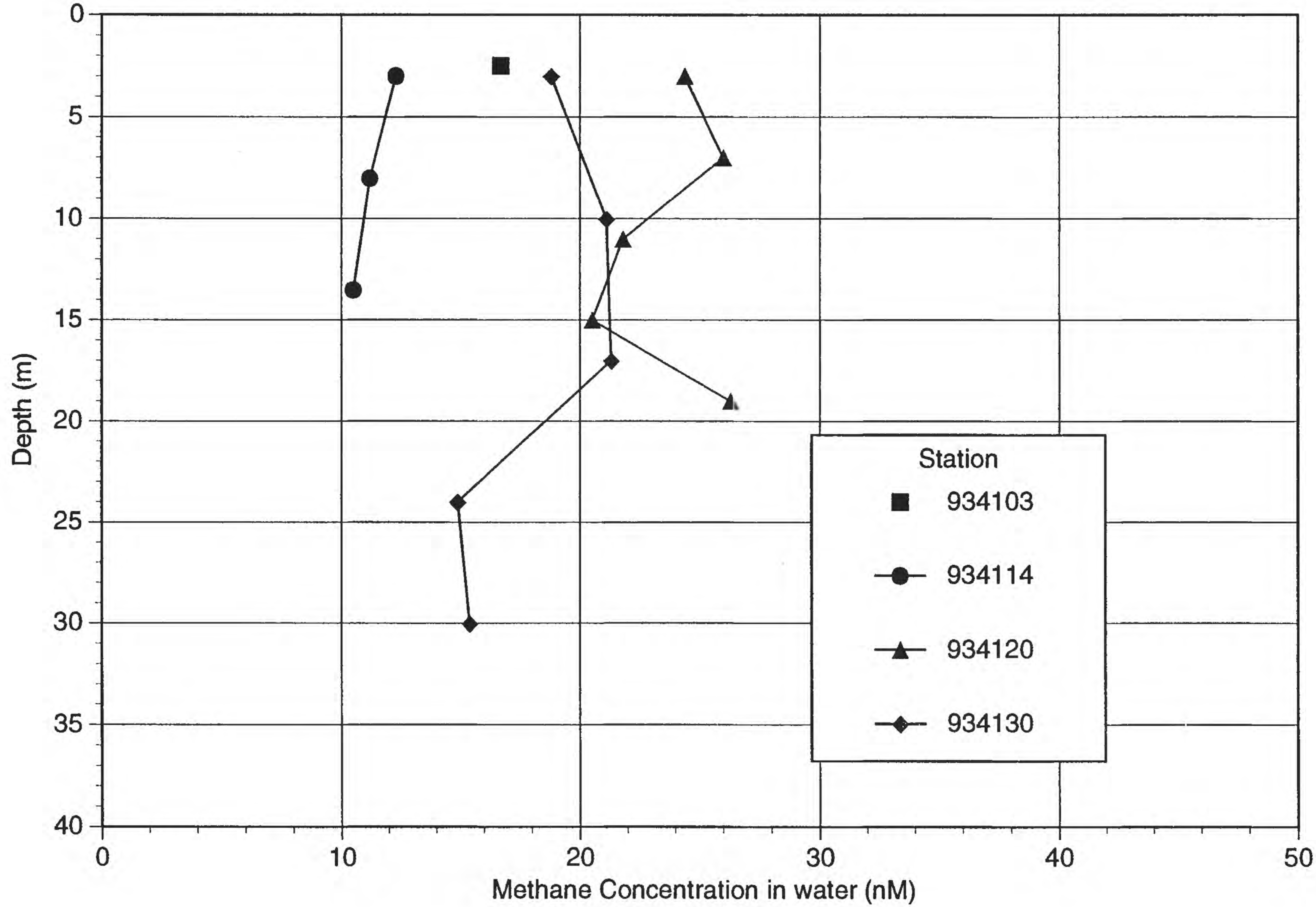


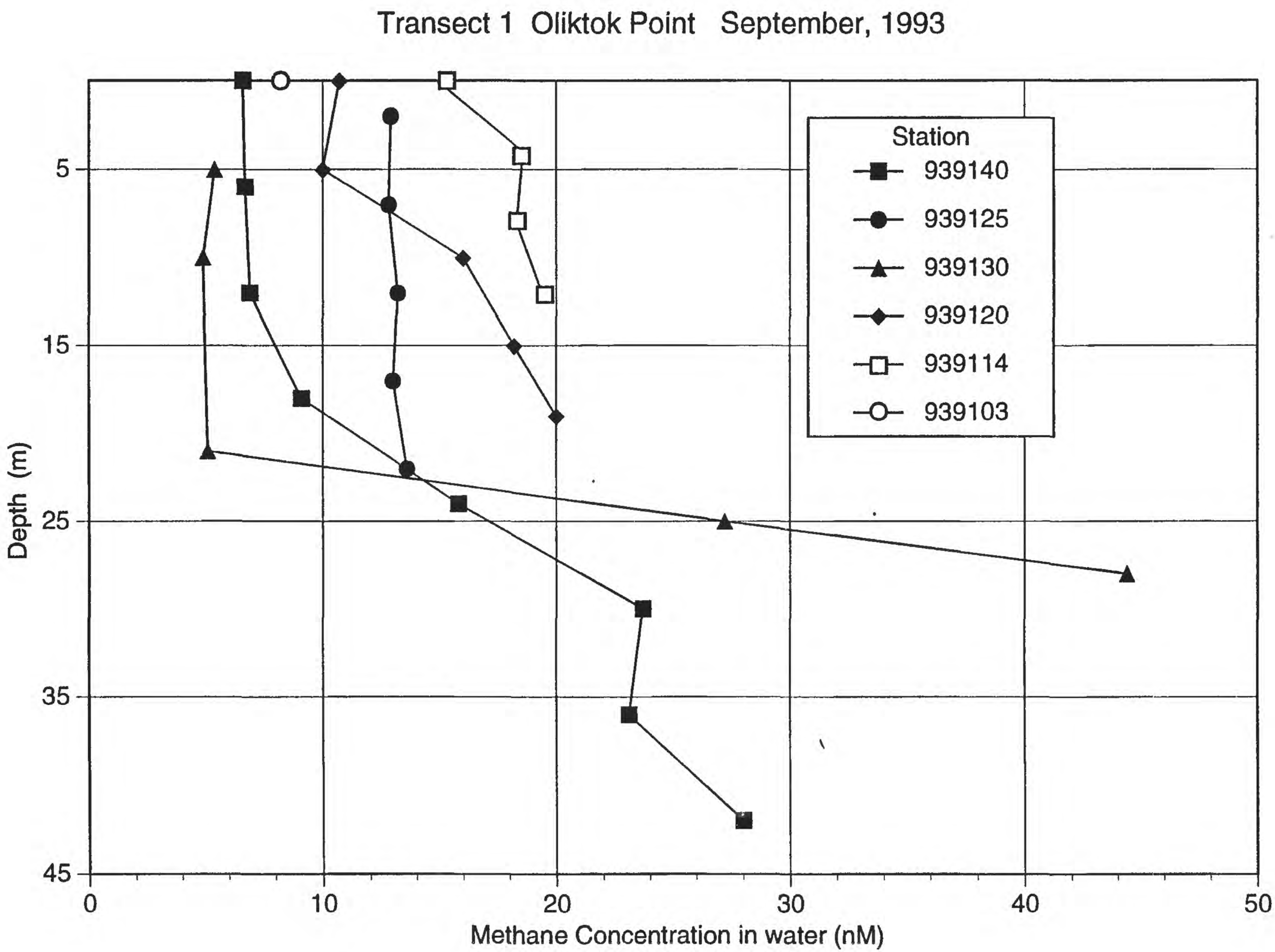
Appendix 2

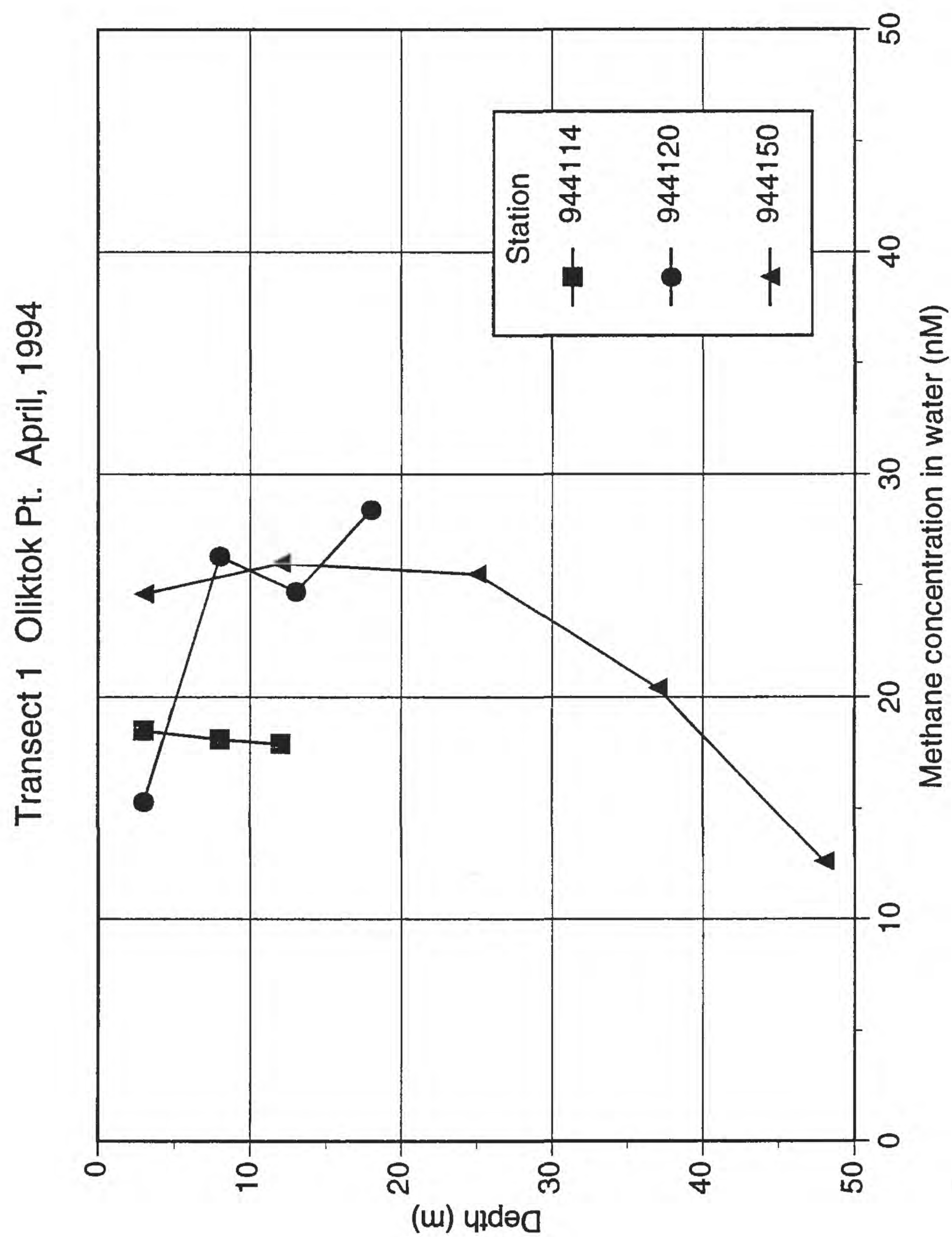
Methane concentrations in water plotted with water depths grouped by transects from each survey

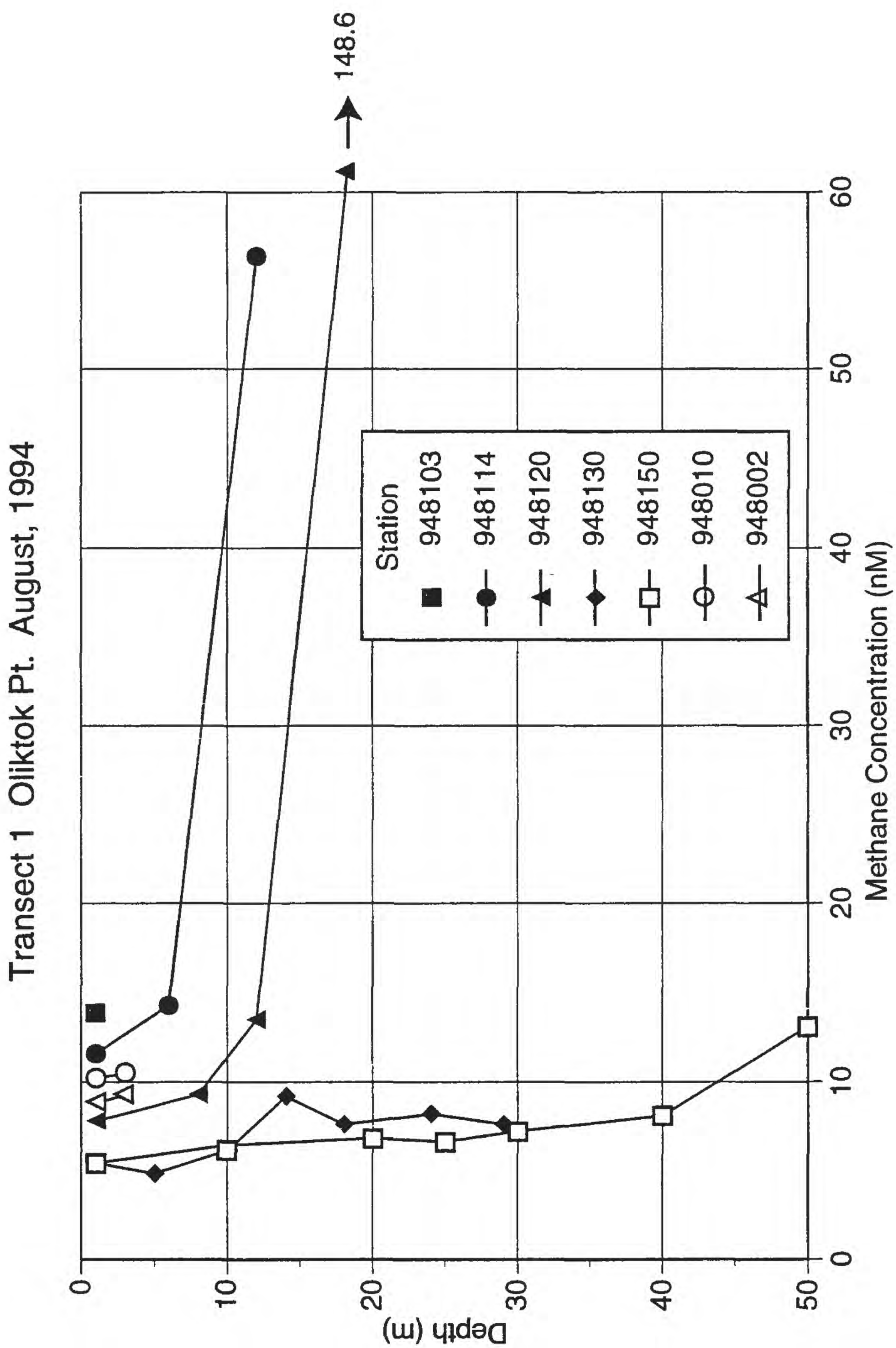

Transect 1 Oliktok Point May, 1992
Depth (m)
Methane concentration in water (nM)
0
10
20
30
40
50
60
70
80
90
0
20
40
60
80
100
120
Station
925010
925114
925120
925130
925150
925188

Transect 1 Oliktok Point April, 1993



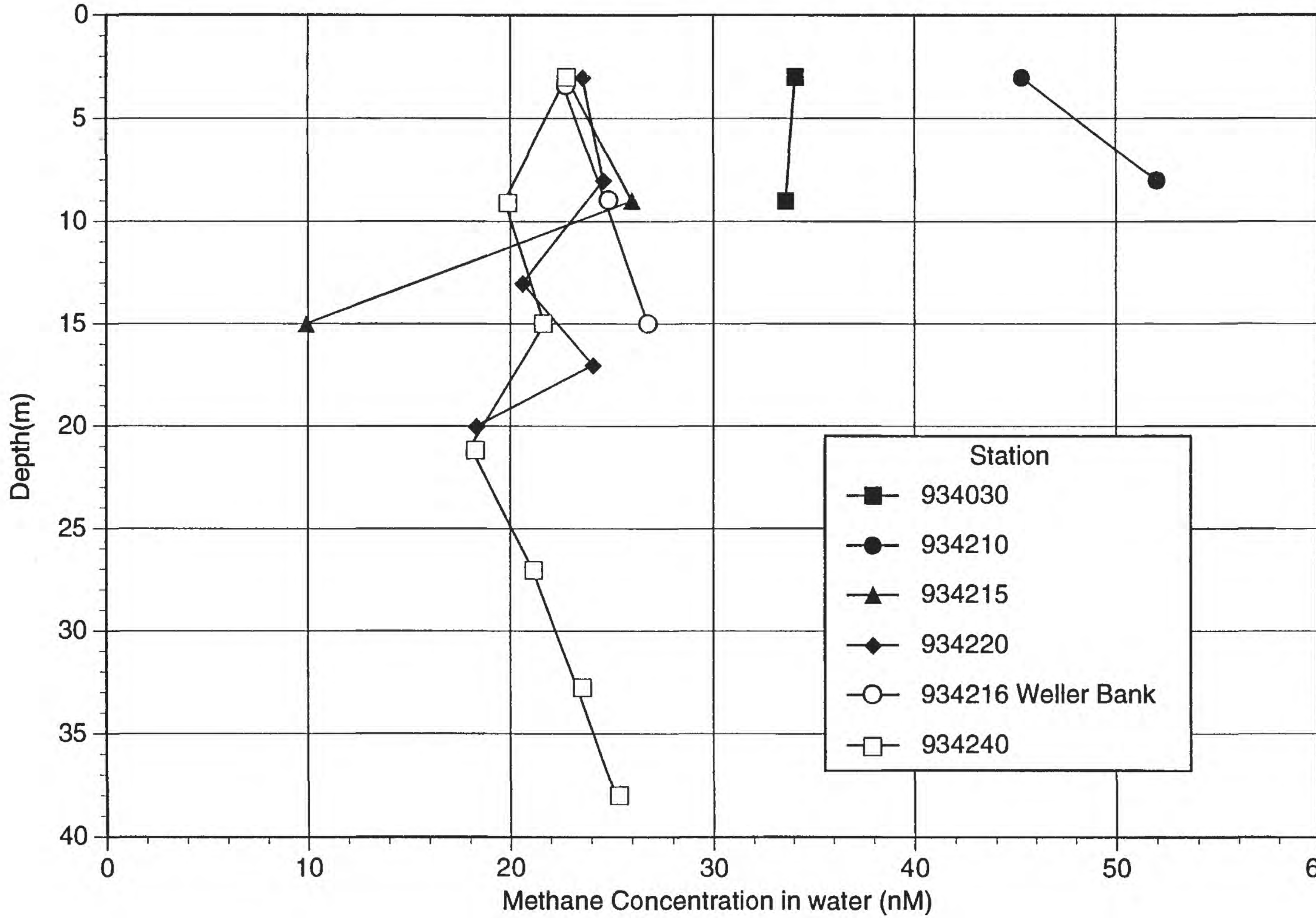

Transect 1 Oliktok Point September, 1993
Station
939140
939125
939130
939120
939114
939103
Depth (m)
5
15
25
35
45
0
10
20
30
40
50
Methane Concentration in water (nM)


Transect 1 Oliktok Pt. April, 1994
Depth (m)
0
10
20
30
40
50
Methane concentration in water (nM)
Station
944114
944120
944150

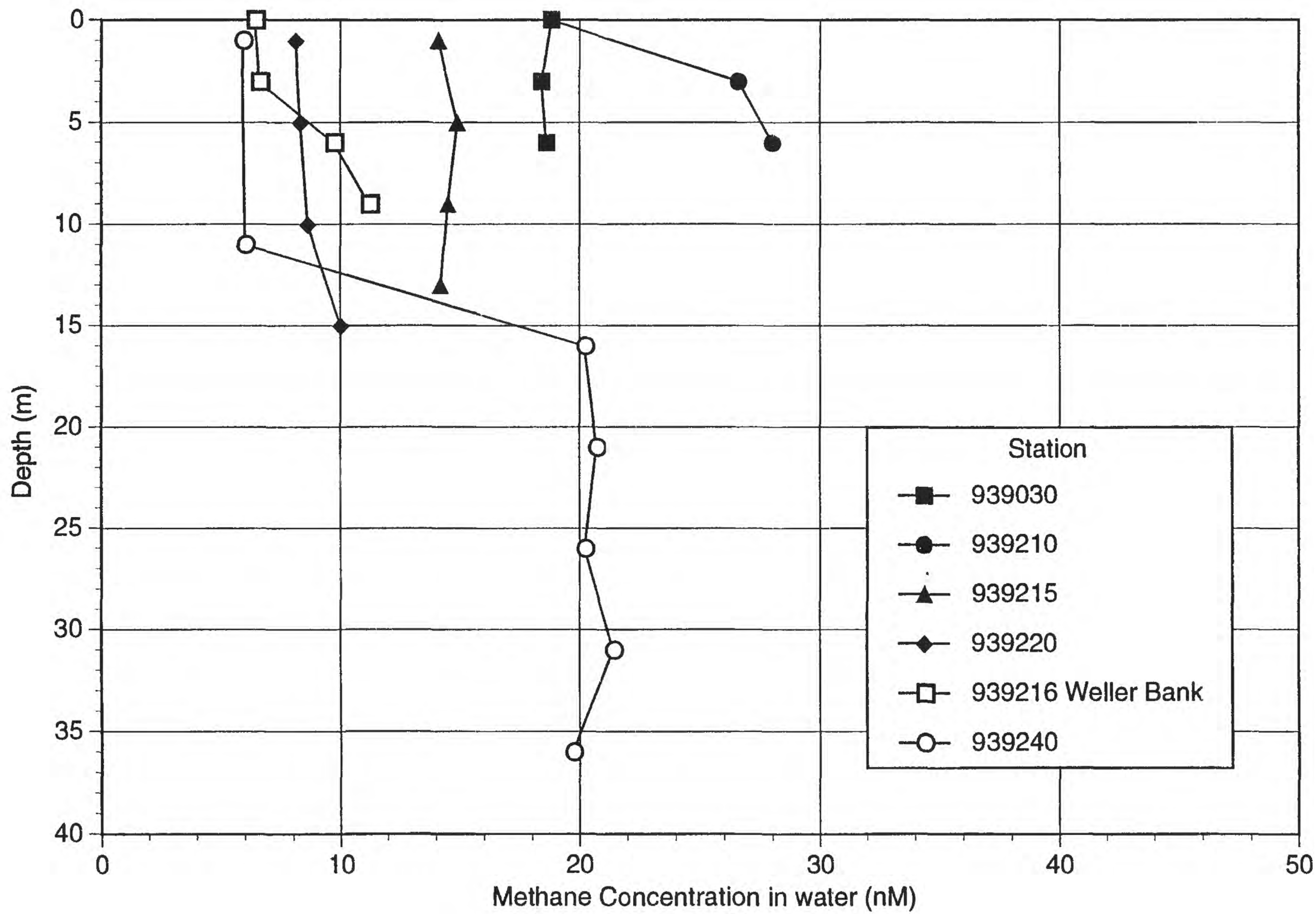


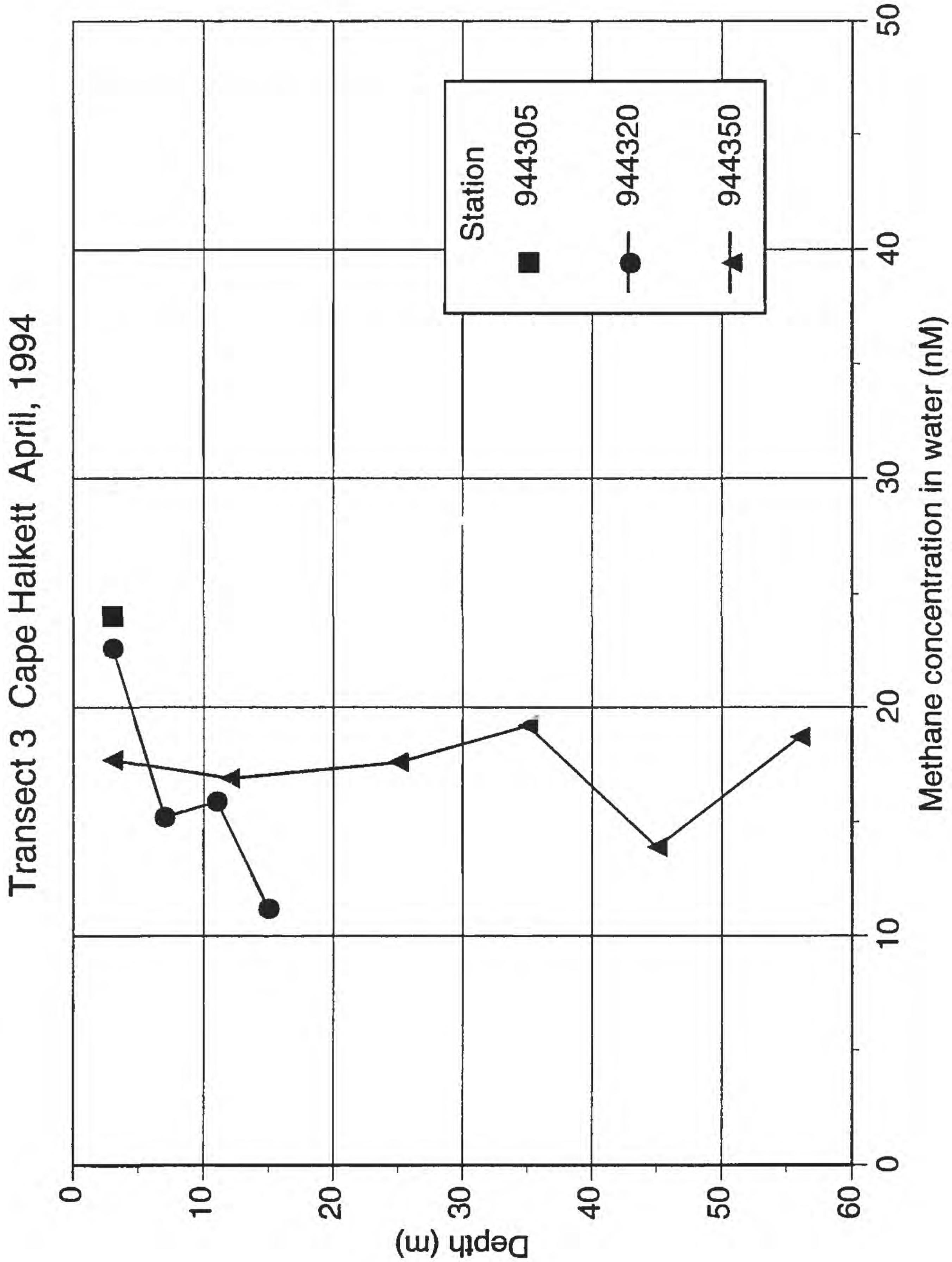
Transect 1 Oliktok Pt. August, 1994
Depth (m)
Methane Concentration (nM)
Station
948103
948114
948120
948130
948150
948010
948002
148.6
0
10
20
30
40
50
60

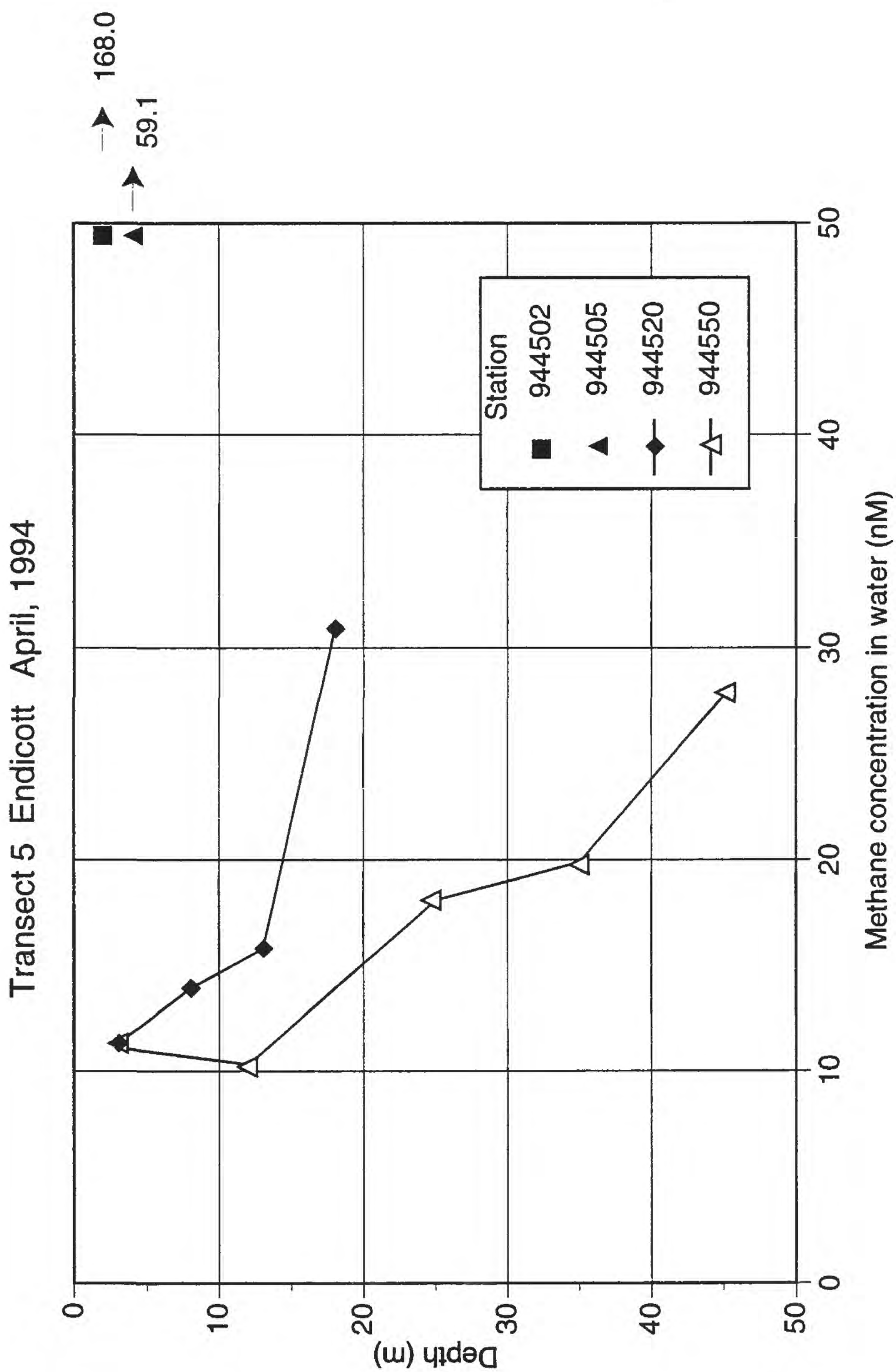
Transect 2 Colville River April, 1993



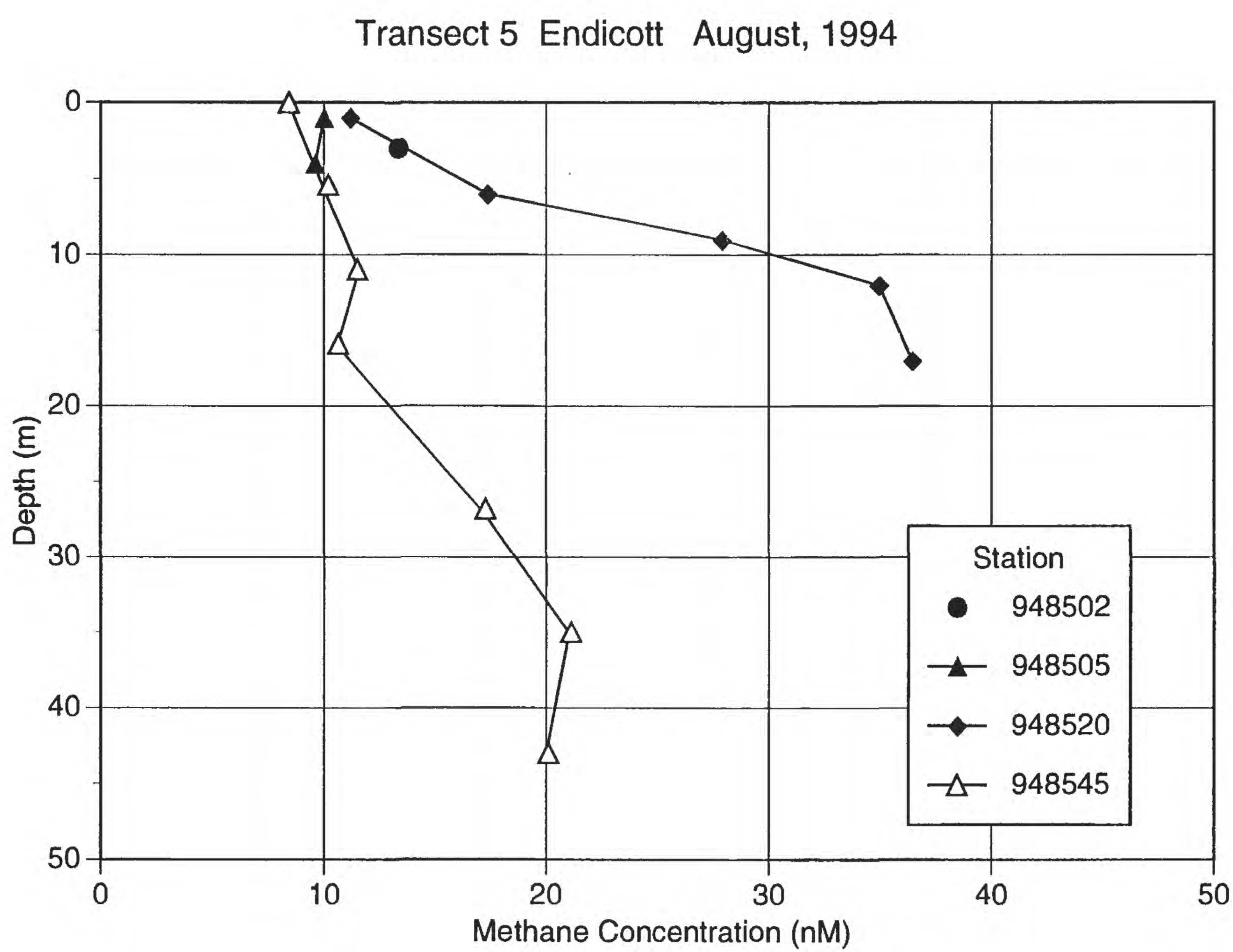
Transect 2 Colville River September, 1993

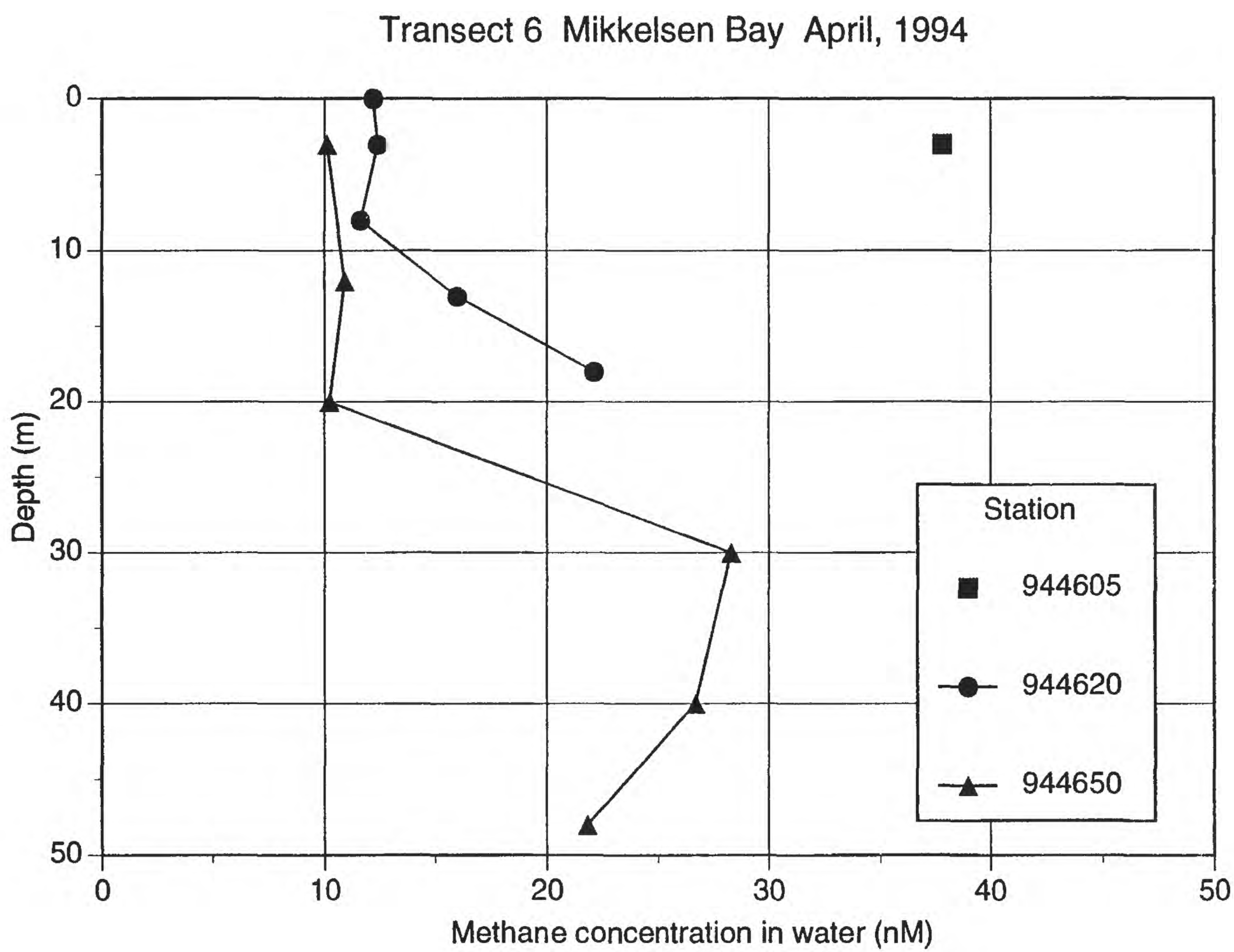


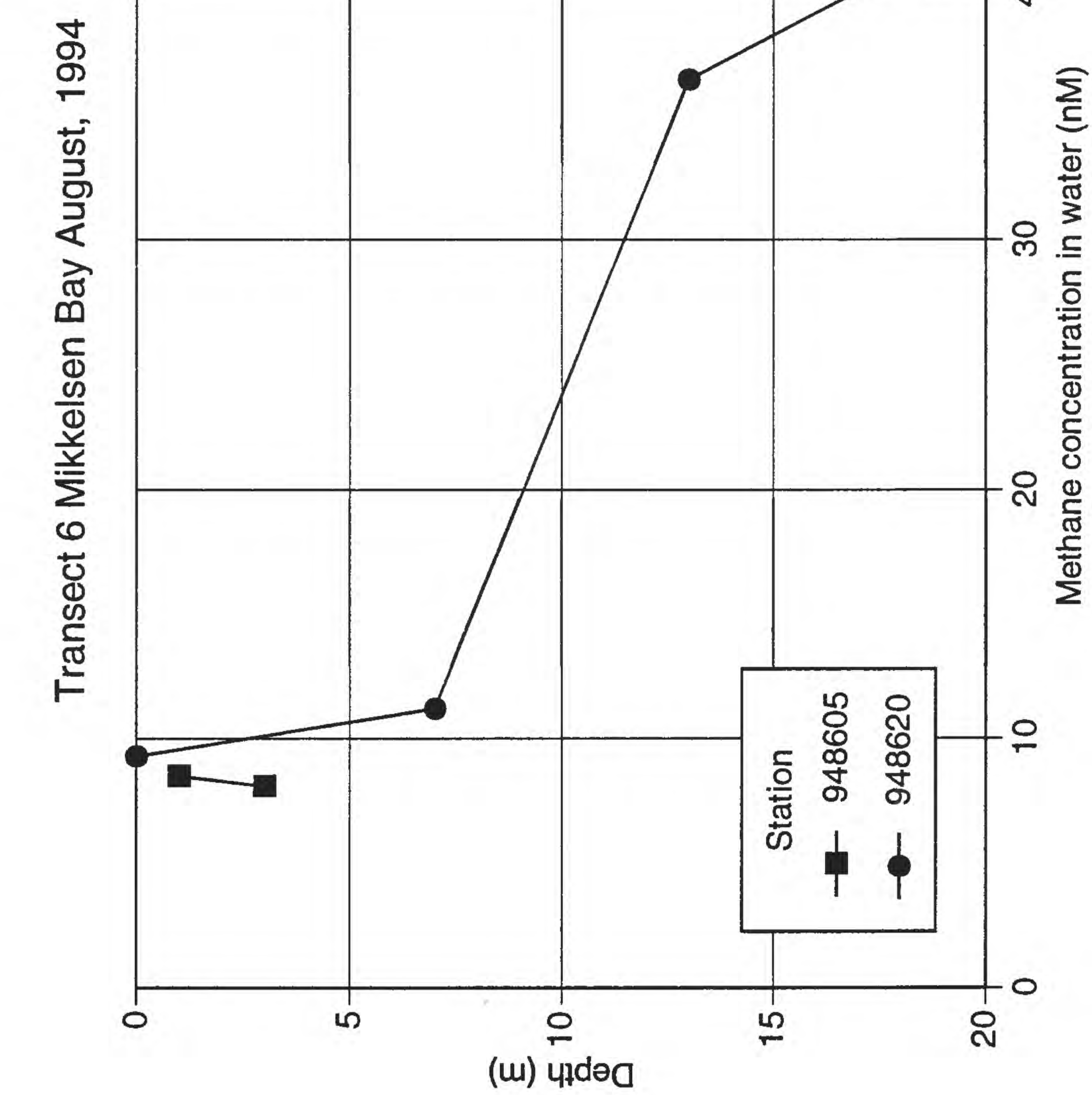

Transect 3 Cape Halkett April, 1994
Station
944305
944320
944350
Depth (m)
Methane concentration in water (nM)
0
10
20
30
40
50
60
0
10
20
30
40
50



Transect 5 Endicott April, 1994
Depth (m)
0
10
20
30
40
50
Methane concentration in water (nM)
0
10
20
30
40
50
168.0
59.1
Station
944502
944505
944520
944550

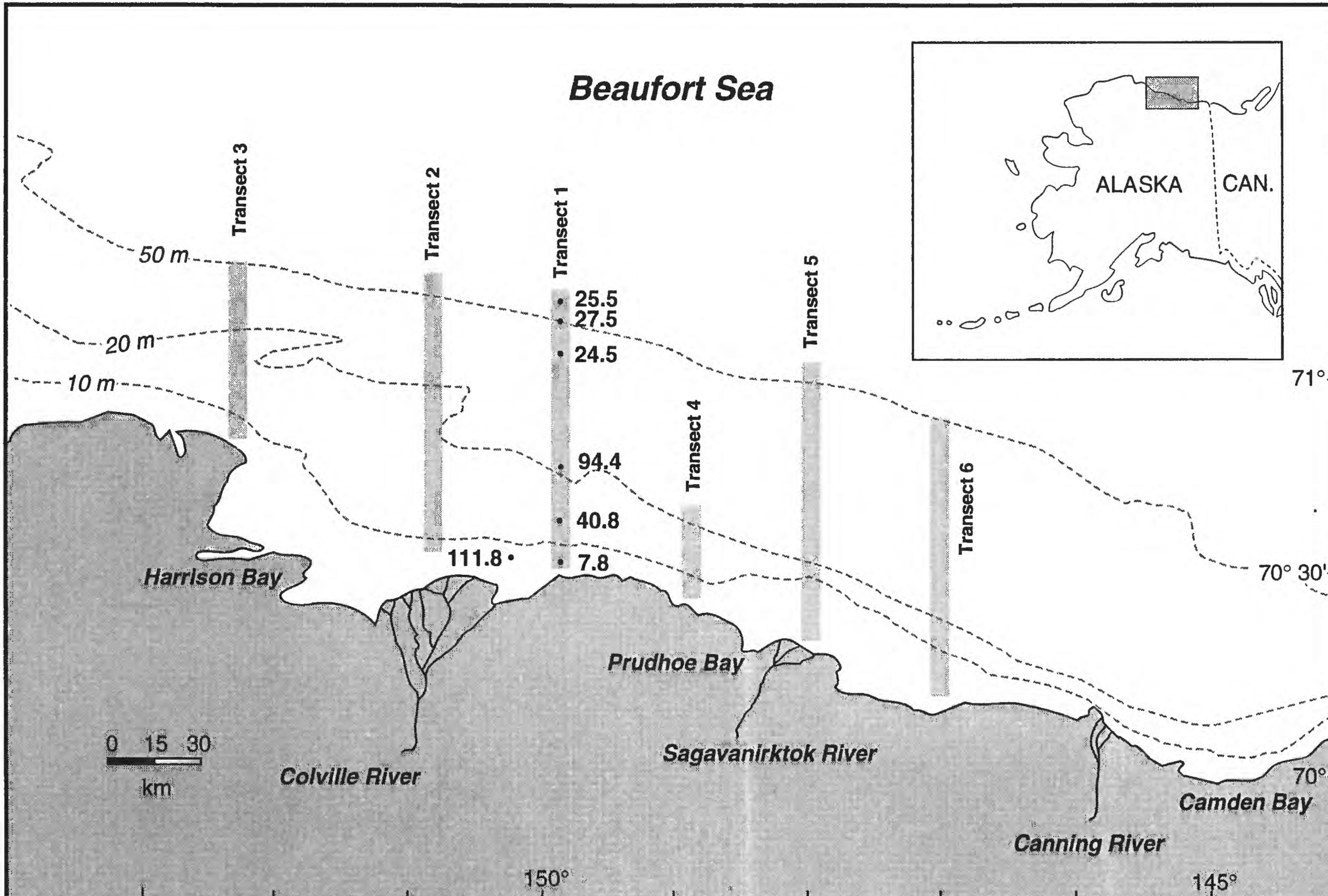

Transect 5 Endicott August, 1994
0
10
20
30
40
50
Depth (m)
0
10
20
30
40
50
Methane Concentration (nM)
Station
948502
948505
948520
948545


Transect 6 Mikkelsen Bay April, 1994
Depth (m)
0
10
20
30
40
50
Methane concentration in water (nM)
Station
944605
944620
944650

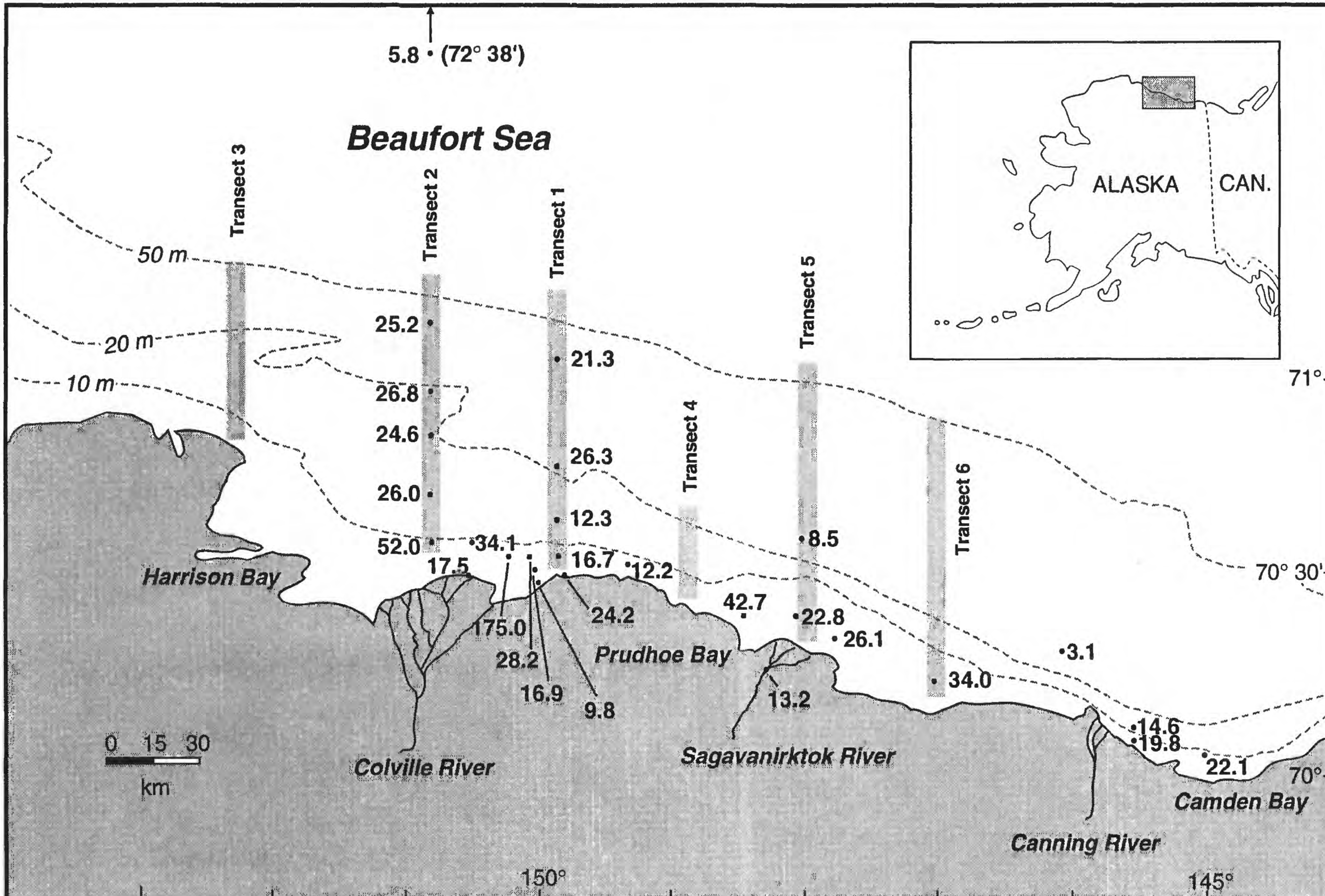

Transect 6 Mikkelsen Bay August, 1994
Depth (m)
0
5
10
15
20
Methane concentration in water (nM)
0
10
20
30
40
50
Station
948605
948620

Appendix 3

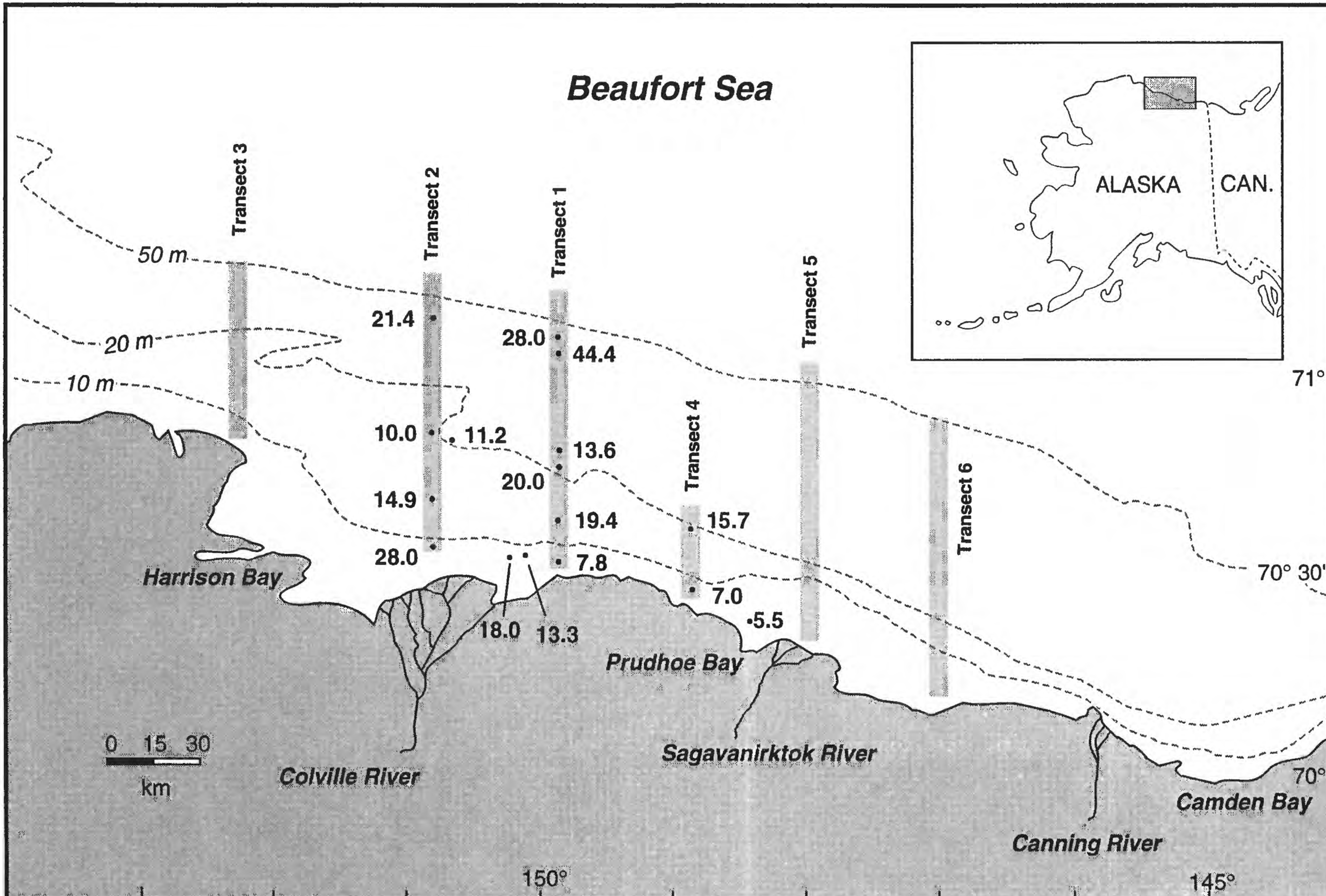
Map view of maximum methane concentrations in water for each survey



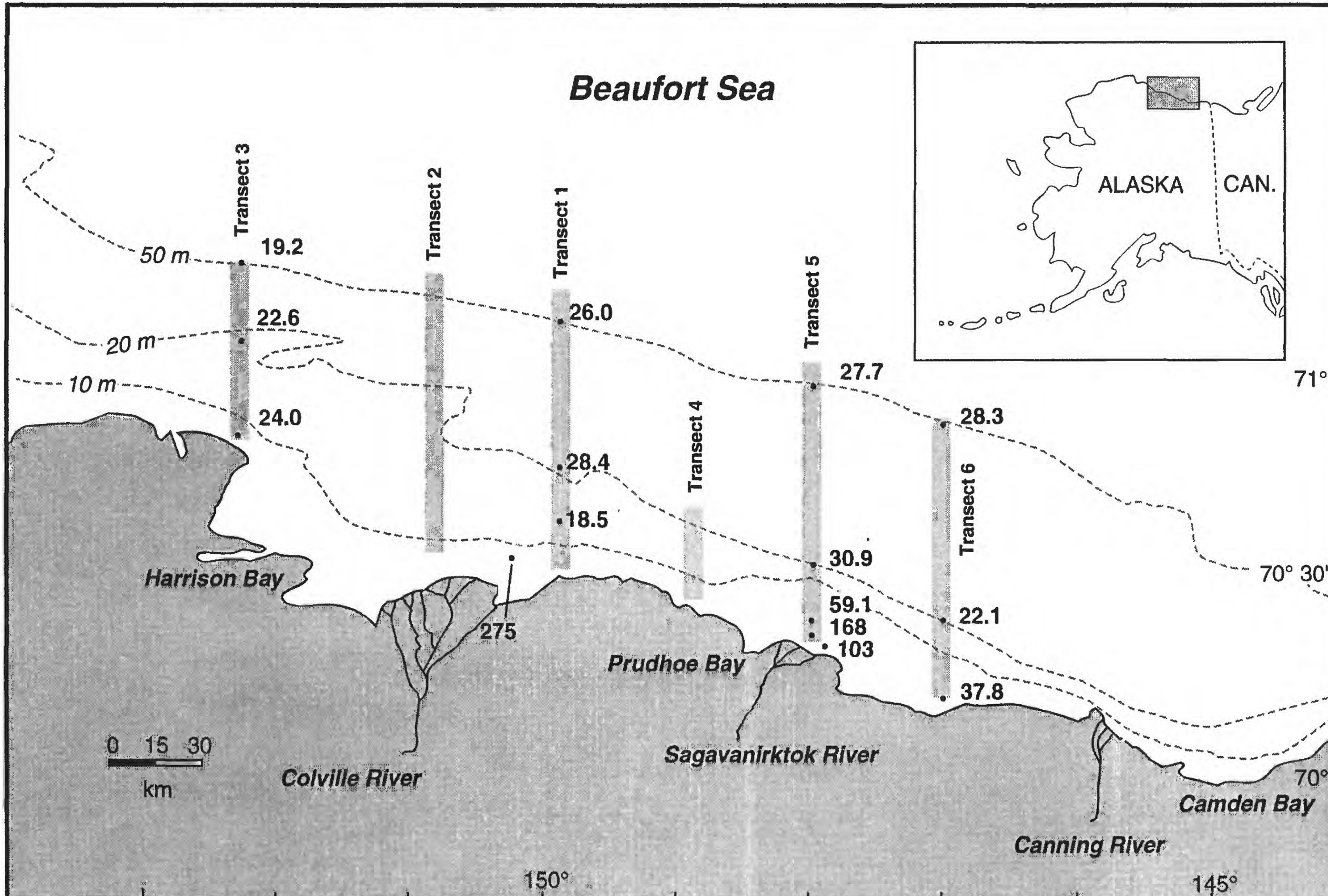
Maximum methane concentration (nM) in water May, 1992



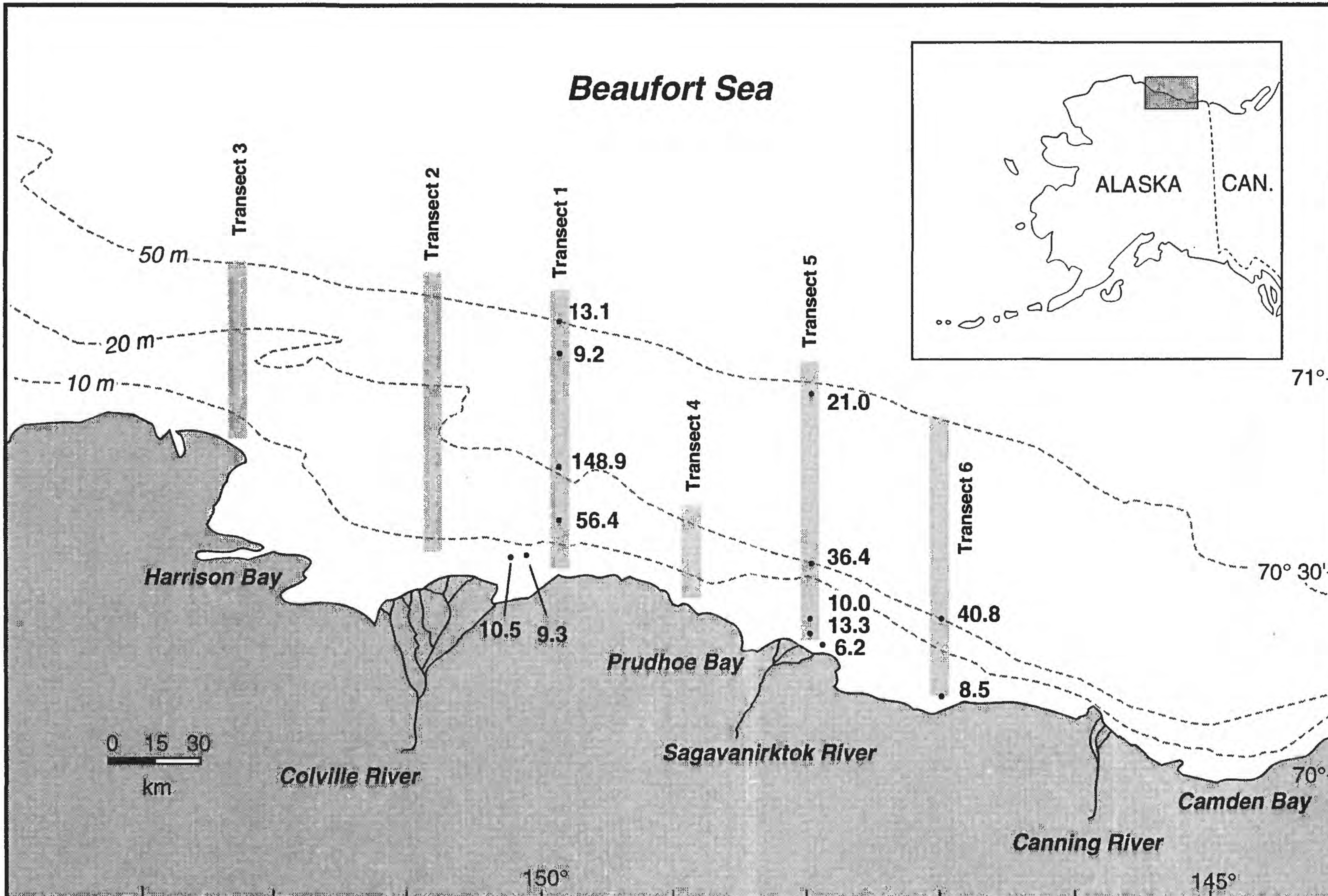
Maximum methane concentration (nM) in water, April, 1993



Maximum methane concentrations (nM) in water September, 1993



Maximum methane concentrations (nM) in water April, 1994

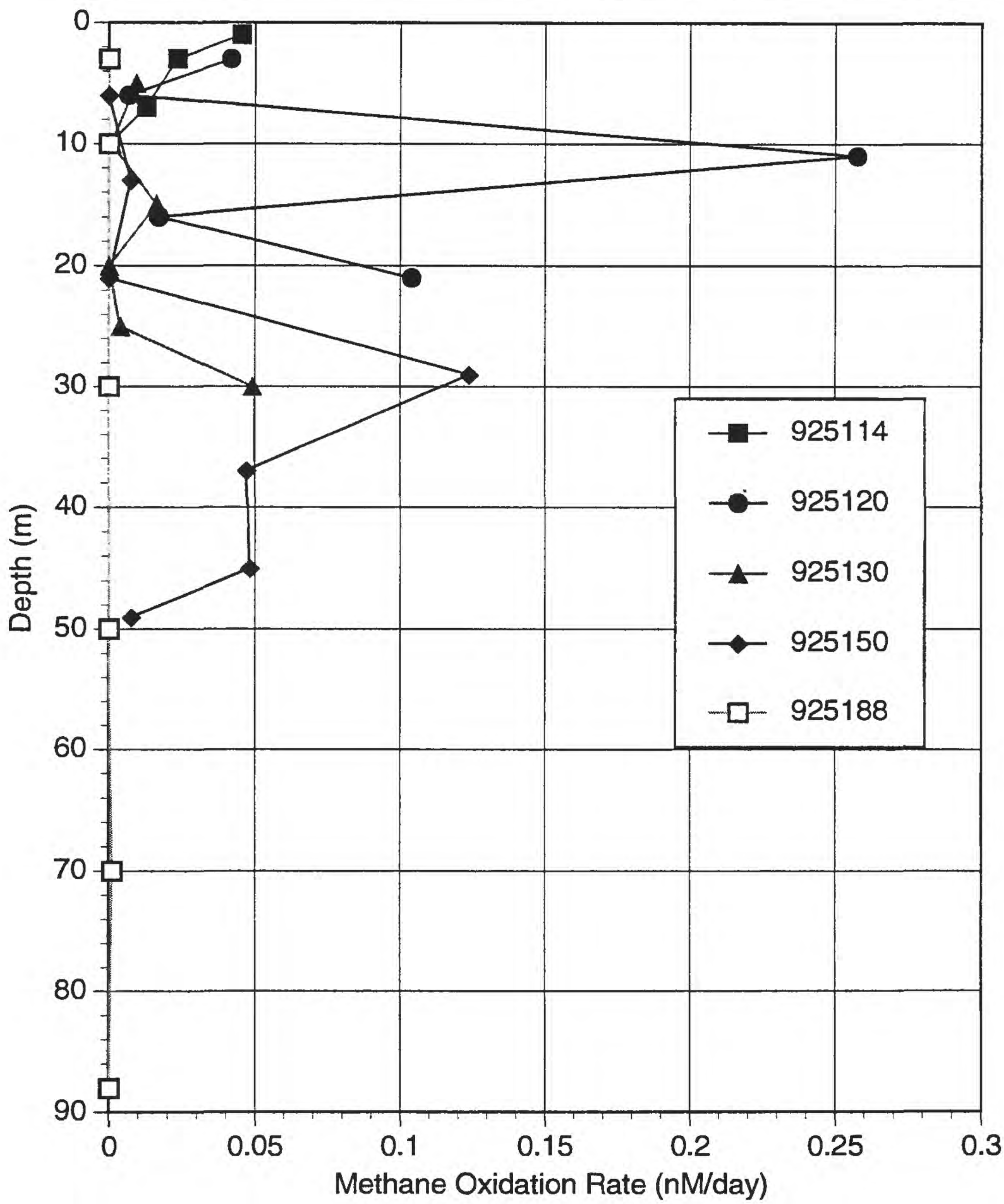


Maximum methane concentrations (nM) in water August, 1994

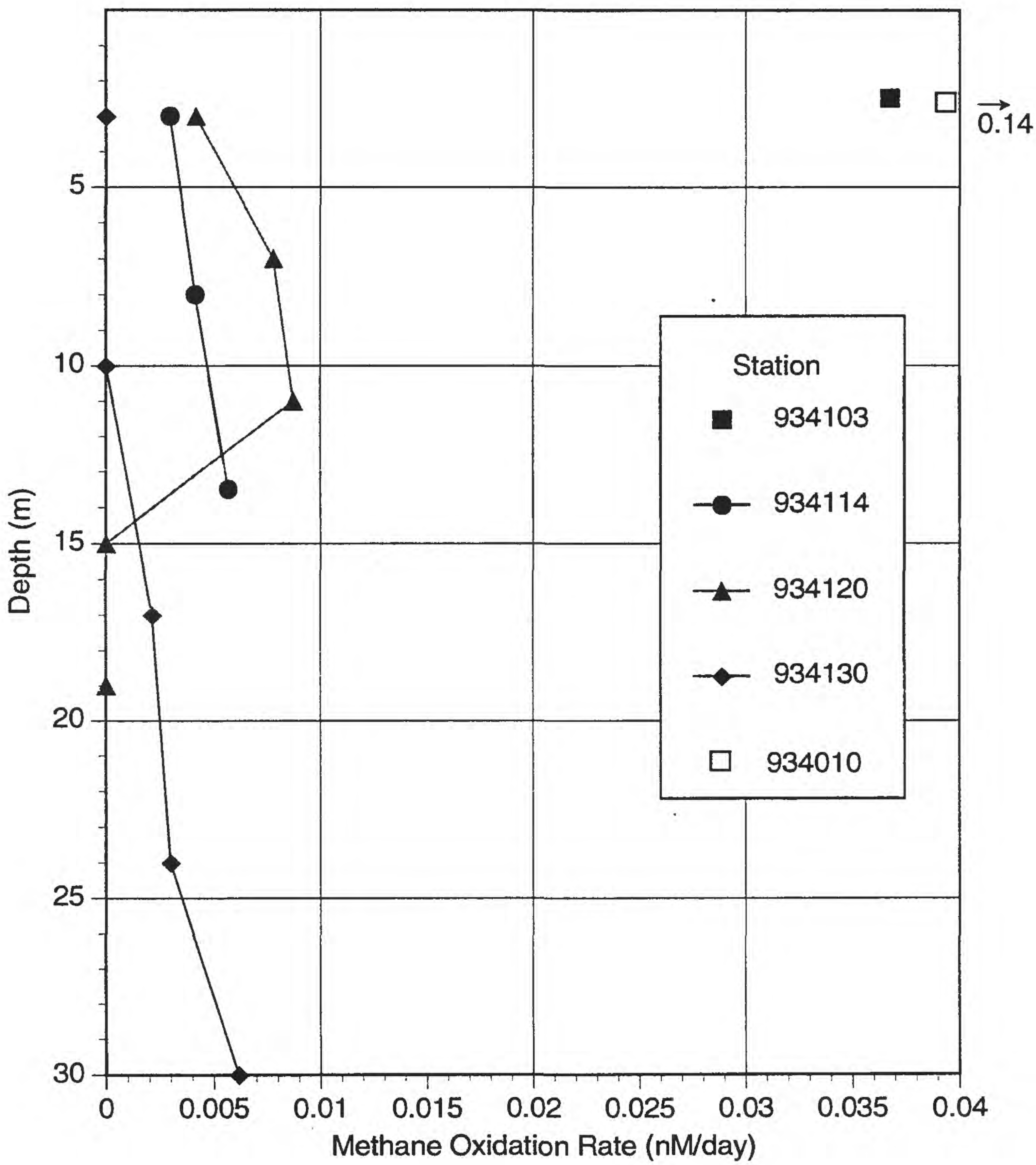
Appendix 4

Methane oxidation rates of water plotted with water depth grouped in transects conducted in each survey

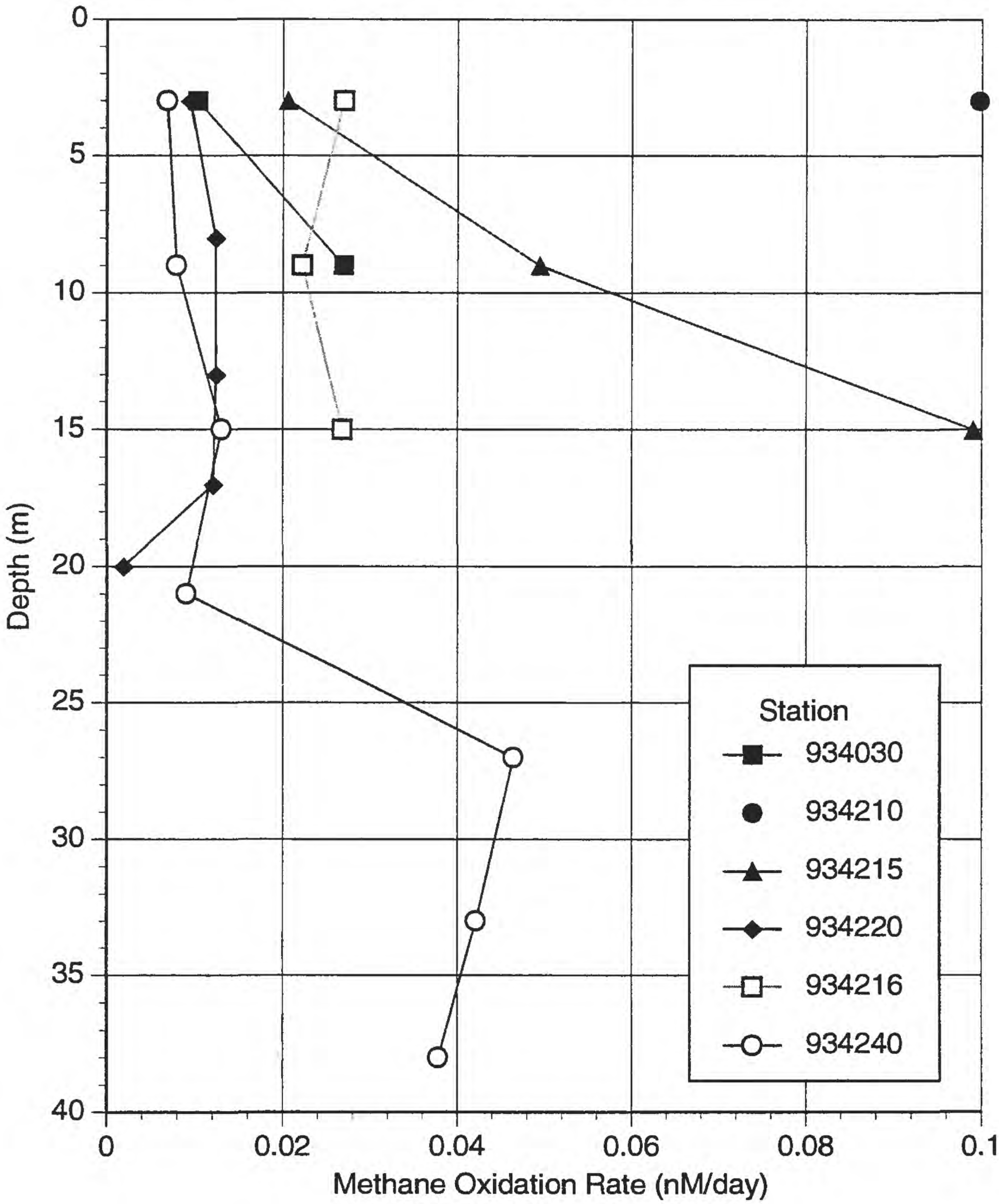
Methane oxidation rates in water, Transect 1 Oliktok Point May, 1992



Methane oxidation rates in water, Transect 1 Oliktok Point April, 1993

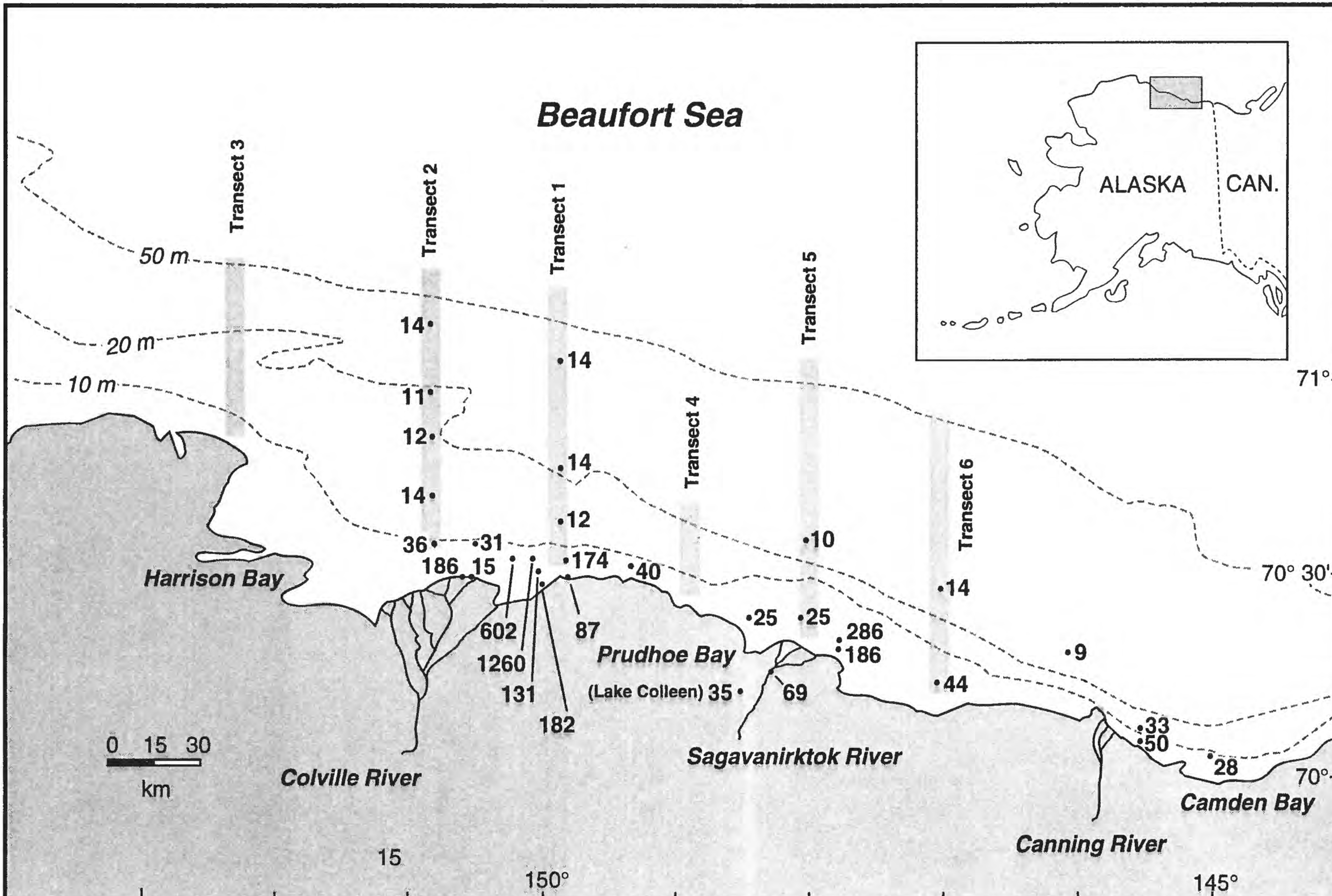


Methane oxidation rates in water, Transect 2 Colville River April, 1993

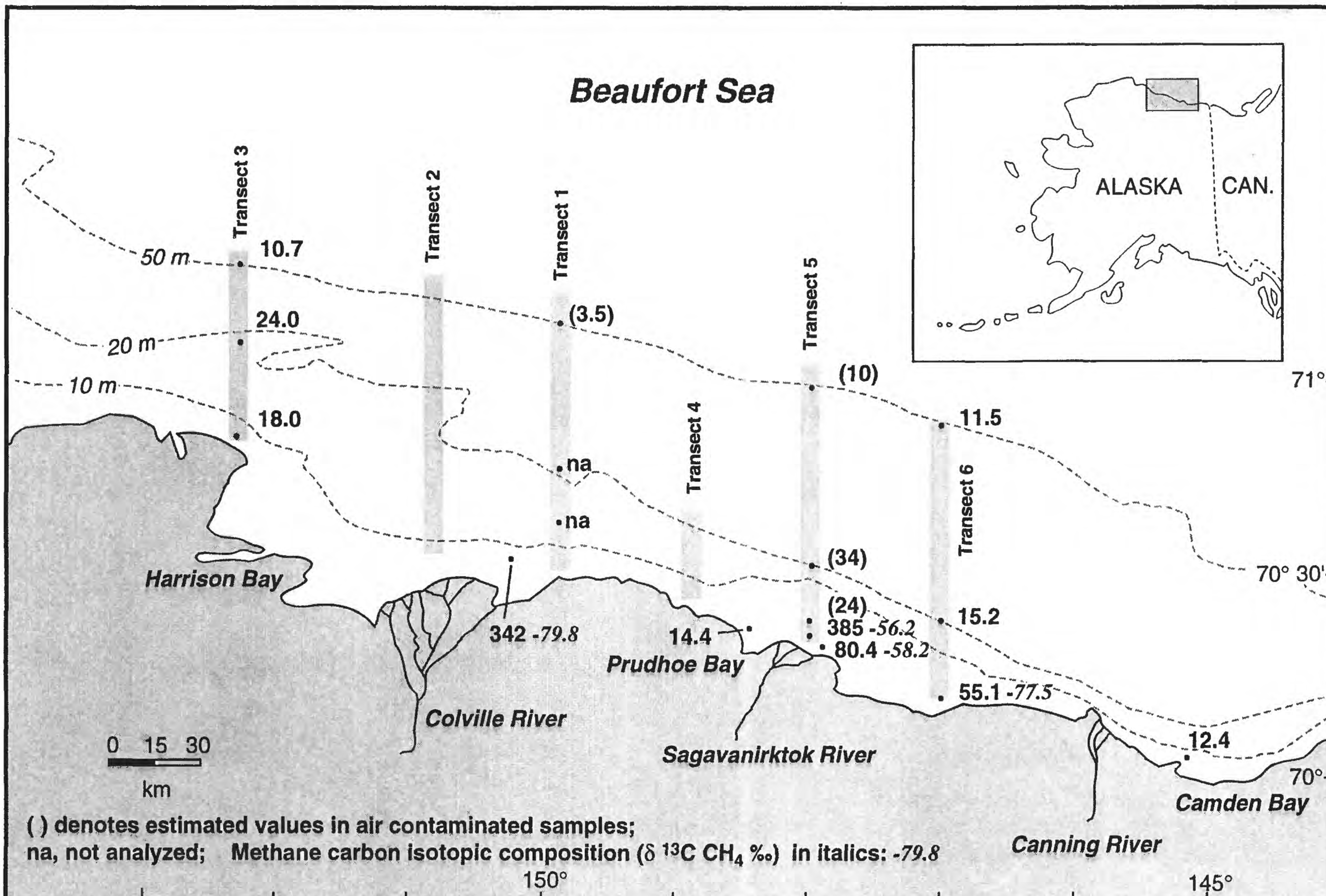


Appendix 5

Map view of maximum methane concentrations in ice for each survey



Maximum Methane Concentration (nM) in ice, April, 1993

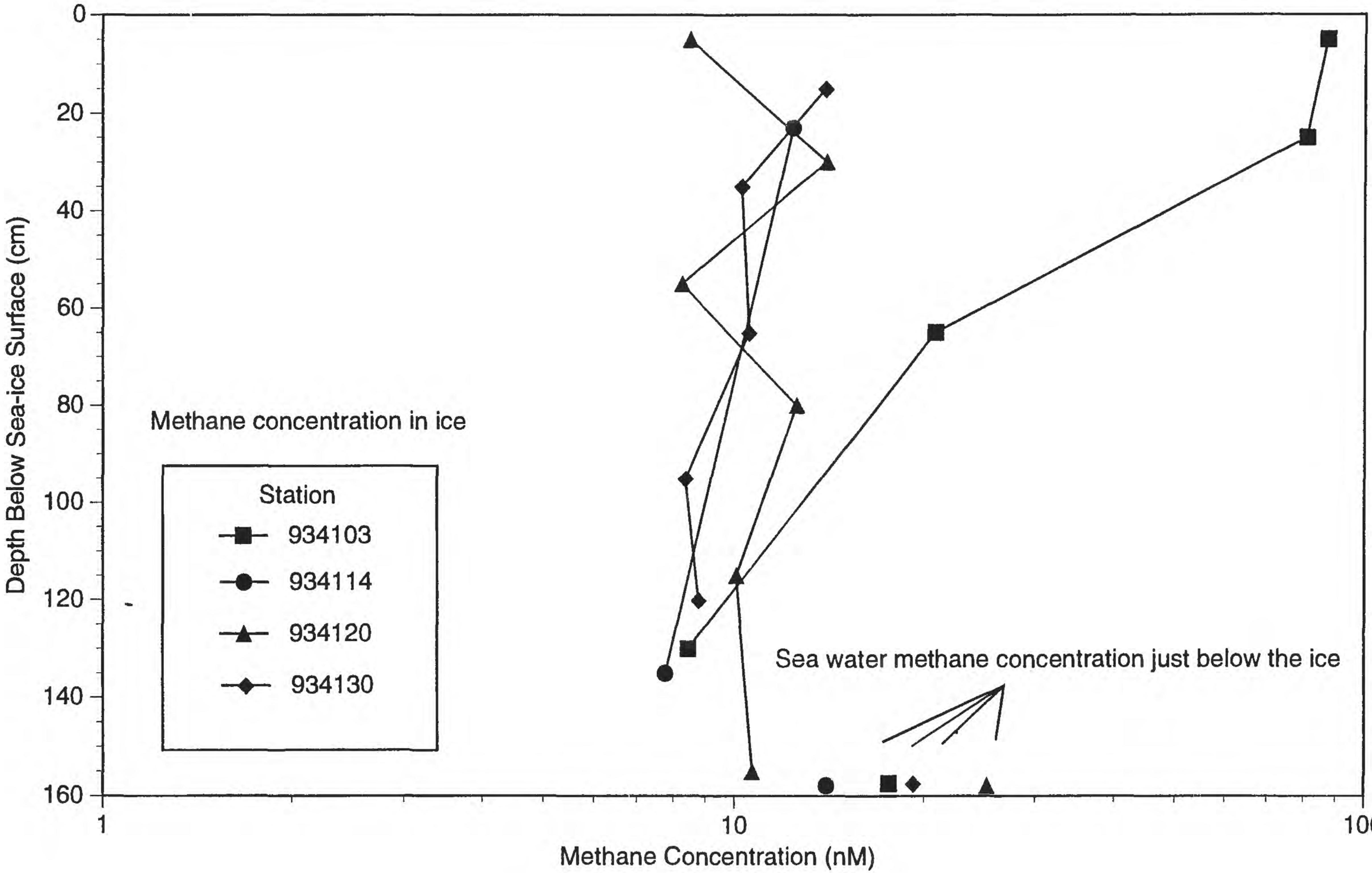


Maximum methane concentrations (nM) in ice, April 1994

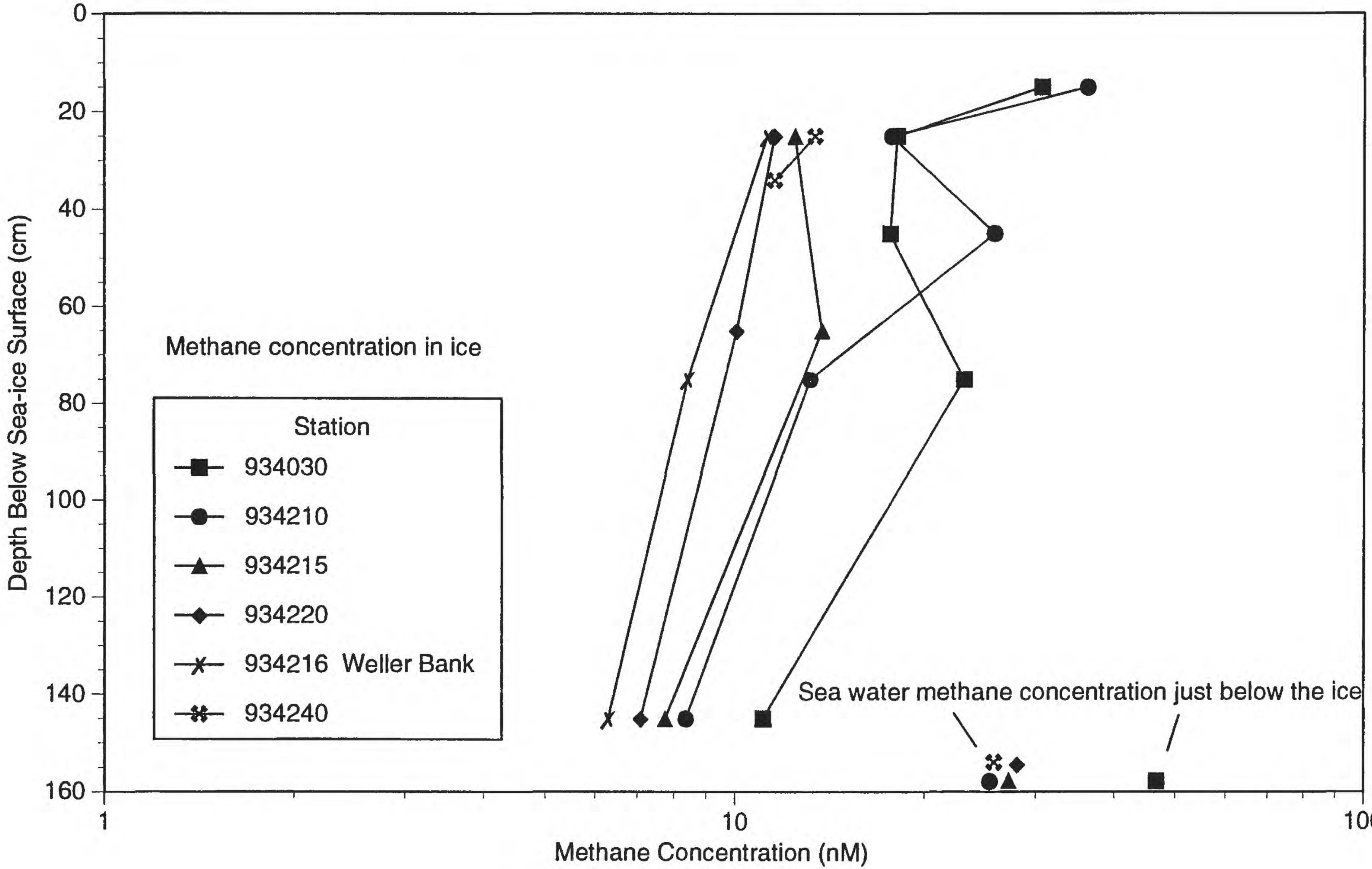
Appendix 6

Methane concentrations of ice plotted with ice depth, grouped in transects

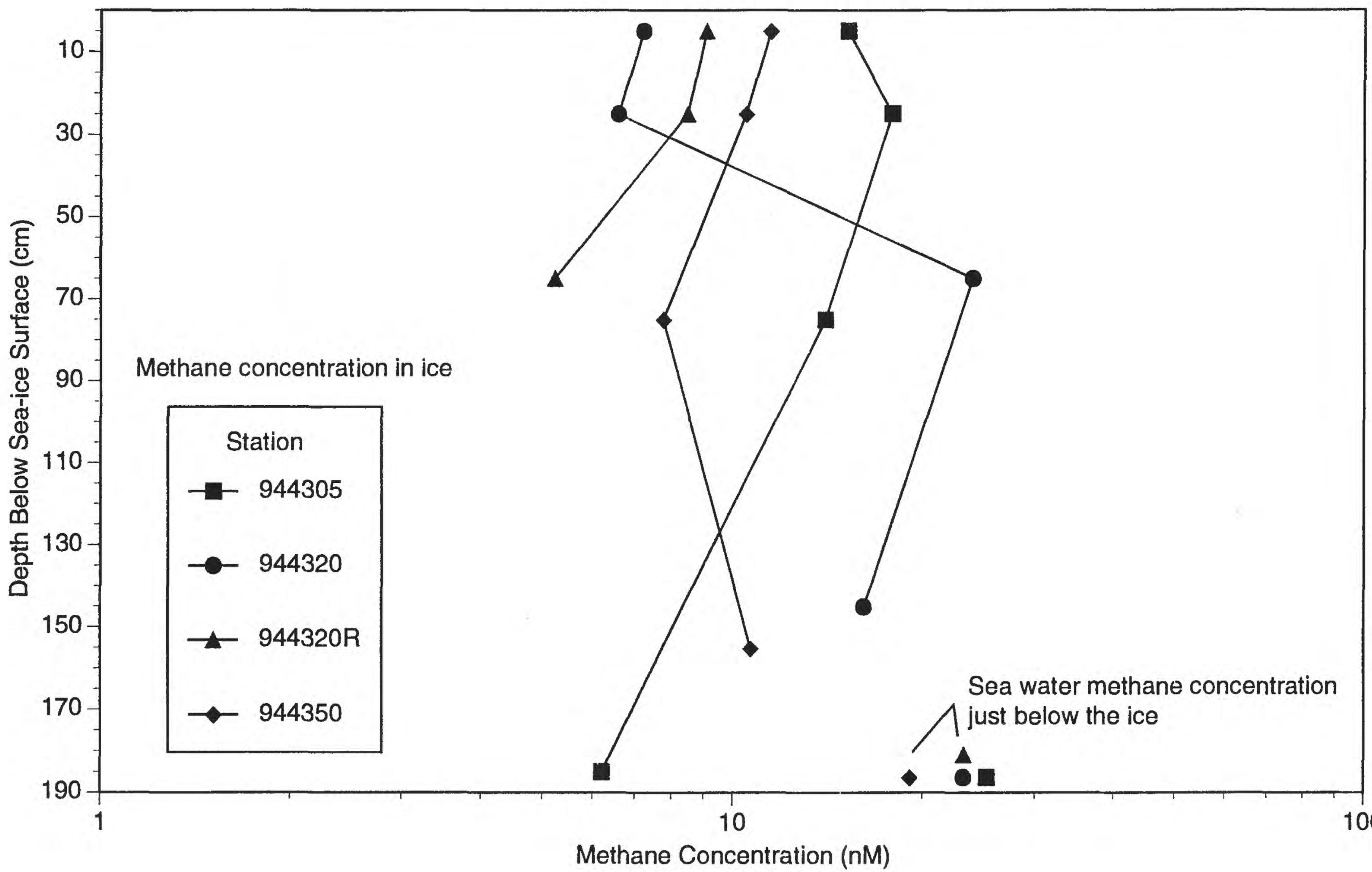
Transect 1 Oliktok Point April, 1993



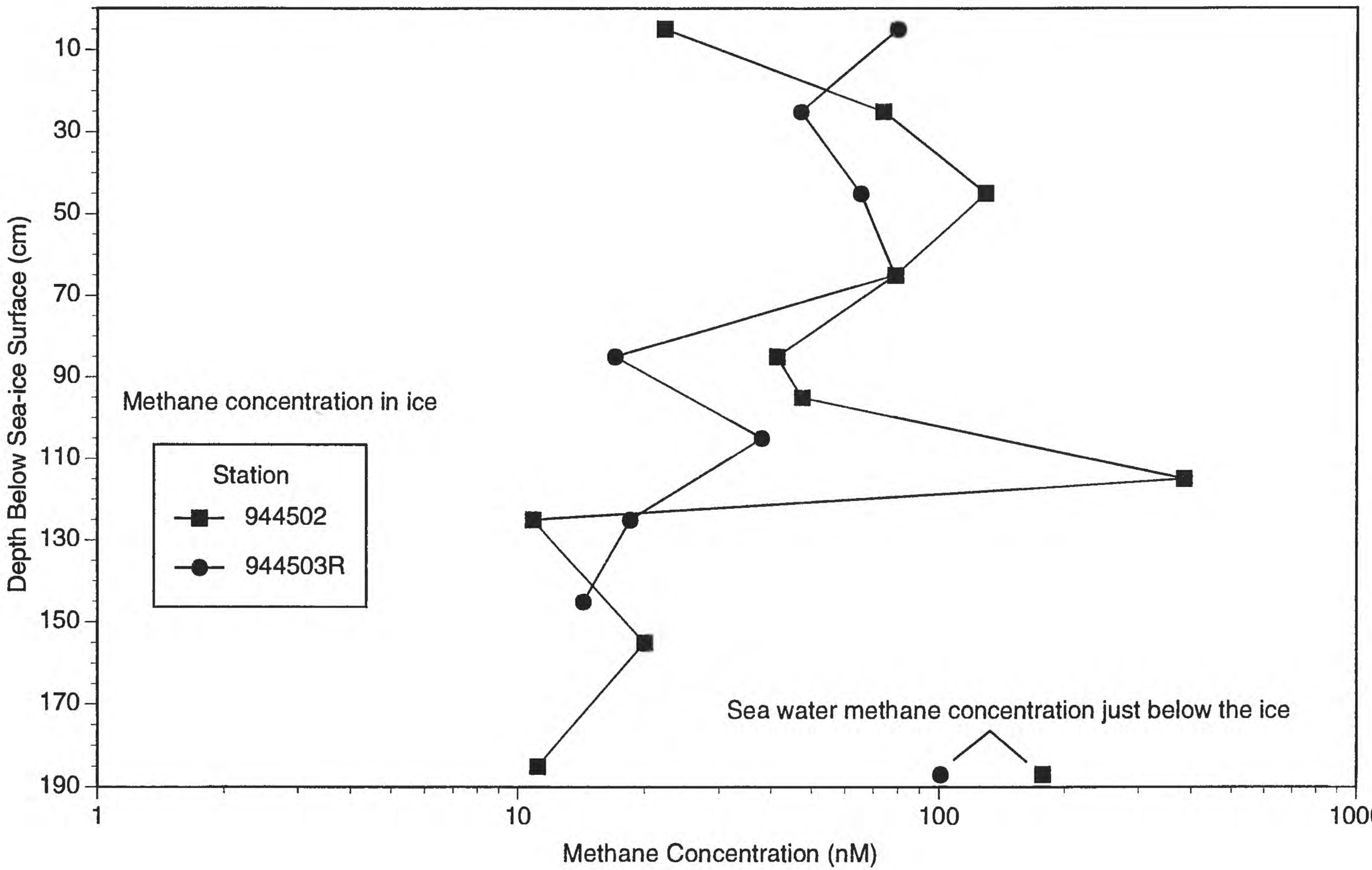
Transect 2 Colville River April, 1993



Transect 3 Cape Halkett April,1994



Enidicott Island vicinity (Main Production Island) April, 1994



Transect 6 Mikkelsen Bay April, 1994