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Limnological Data from the 1985-1990 Study of Quesnel Lake

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LIMNOLOGICAL DATA FROM THE 1985-1990 STUDY OF QUESNEL LAKE

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ABSTRACT

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Results of a limnological investigation of Quesnel Lake are presented. Ten stations were sampled for a variety of physical, chemical and biological variables. Stations were sampled six or seven times each year during 1985-1988 and 1990. Summarized data for each station and date are presented along with selected vertical profiles of *in vivo* fluorescence and temperature.

Key words: Sockeye salmon (*Oncorhynchus nerka*), dimictic, oligotrophic, nutrients, bacteria, picoplankton, phytoplankton, zooplankton, lake trophy.

RÉSUMÉ

Nidle, B.H., K.S. Shortreed and K.V. Masuda. 1994. Limnological data from the 1985-1990 study of Quesnel Lake. Can. Data Rep. Fish. Aquat. Sci. 940:82p.

On présente les résultats d'une étude limnologique du lac Quesnel; 10 stations ont fait l'objet d'échantillonnage pour divers paramètres physiques, chimiques et biologiques. On a échantillonné 6 ou 7 fois par an à chaque station, de 1985 à 1988, et en 1990. On présente un résumé par station et par date, de même que certains profils verticaux choisis de fluorescence et de température *in vivo.*

Mot clés : Saumon rouge (*Oncorhynchus nerka),* dimictique, oligotrophe, éléments nutritifs, bactéries, picoplancton, phytoplancton, zooplancton, limnotrophie

INTRODUCTION

Sockeye salmon (*Oncorhynchus nerka*) are the most economically valuable species of salmon harvested in British Columbia, with an annual catch often worth hundreds of millions of dollars. Since juvenile sockeye spend at least 1 yr in lakes before seaward migration, factors affecting their freshwater growth and survival are of paramount importance in determining their ocean survival rate and ultimately their numbers as returning adults. Quesnel Lake is one of the largest sockeye producing lakes in the Fraser River system. It strongly exhibits the cyclicity common to some Fraser River lakes (a 4-yr cycle of abundance, with 1 dominant return, 1 much smaller sub-dominant return, and 2 very small non-dominant returns). Our study of Quesnel Lake began in 1985. Data collected in this study and presented in this report will be used to determine how variations in temperature, light and water chemistry affect lake trophy, to determine the relationships between the highly cyclic Quesnel Lake sockeye salmon stocks and the lake's phytoplankton and zooplankton community structure, and to develop a carrying capacity model for Quesnel Lake (that could also be applied to other Fraser River lakes) to maximize adult sockeye production. These data will be combined with data on juvenile sockeye salmon and zooplankton species composition (Morton and Williams 1990; Enzenhofer *et al* 1991; Mueller and Enzenhofer 1991; Mueller *et al* 1992; Maclellan *et al* 1993) to achieve project objectives.

DESCRIPTION OF QUESNEL LAKE

Quesnel Lake (elevation = 725 m, surface area = 270 km^2, mean depth = 158 m) is situated in the east-central portion of the Fraser River drainage basin (Fig. 1). It is located in the interior western hemlock biogeoclimatic zone, receives an annual rainfall of 50-250 cm and experiences severe winters and warm, dry summers (Farley 1979). Quesnel is a dimictic, oligotrophic lake with a relatively small littoral zone, low inorganic nutrient levels and low phytoplankton biomass (Stockner and Shortreed 1983, 1989, 1991). Despite high annual precipitation and a large drainage basin (5,930 km^2), Quesnel Lake has a relatively long water residence time of 10.8 yr (Stockner and Shortreed 1983). The two main tributaries of Quesnel Lake are the Horsefly and Mitchell rivers (Fig. 2). The lake discharges into the Quesnel River, which subsequently enters the Fraser River. The majority of adult sockeye returning to Quesnel Lake spawn in the Mitchell or Horsefly rivers, with smaller numbers spawning in various small streams in the east arm of the lake, or along the shores of the lake.

METHODS

Limnological surveys were conducted from a float-equipped de Havilland Beaver aircraft in 1985, while boats were used for the remaining years of the study. The number of sampling dates, stations and depths sampled, and the types of analyses carried out for each year and station varied considerably, and are listed in Table 2.

Temperature profiles from the surface to the lake bottom (or a maximum depth of 200 m) were obtained at most stations using Applied Microsystems conductivity, temperature and depth measuring instruments (Model CTD-12 or Model STD-12). Isotherms (Fig. 4) were plotted by the SAS procedure Gcontour (SAS Institute Inc., 1990) from a grid of interpolated and smoothed unscaled data computed by the SAS procedure G3grid (SAS Institute Inc., 1990) using a bivariate method described by Akima (1978). Contour lines from linearly interpolated data pass through the data points of the input data set.

Li-Cor light meters (Model 185A) equipped with Li-Cor underwater quantum sensors (Model Li-192S) were used to measure photosynthetic photon flux density (PPFD: 400-700 nm) from the surface to the compensation depth (1% of surface intensity) and vertical light extinction coefficients were calculated. A standard 22-cm white Secchi disk was used to measure water transparency.

Fluorometer profiles from the surface to a maximum depth of 40 m were obtained with a Turner Designs Model 10 fluorometer in 1986 and an Electro-Optik *in situ* fluorometer coupled with a Linear Instruments Model 142 field chart recorder from 1987-90.

Discrete water samples were obtained from each station during the first two years of the study. In 1985 water was collected from depths of 1,3,5, and 40 m, while 1986 sampling depths were 1,5,10 and 40 m. From 1987-90 the euphotic zone was divided into 2 or 3 distinct zones at each sampling station. Criteria used in establishing zone boundaries included compensation depth, thermocline depth and chlorophyll peaks (if present). Replicate analyses were carried out on integrated samples from each zone. Wherever integrated euphotic zone sampling was done, single hypolimnetic samples (from 30, 40, 50 or 75 m) were also obtained. In addition, samples were taken from discrete vertical profiles at selected stations. An opaque 3- or 6-L Van Dorn bottle rinsed with 95% ethanol was used to collect all water samples. Sampling took place between 0800 and 1200 h. Water from discrete depths was collected in 1-L or 2-L polyethylene bottles, while samples from each of the 2 or 3 zones was integrated in separate 20-L Nalge Lowboy carboys. Most chemical analyses were carried out according to methods given in Stephens and Brandstaetter (1983). Acid washed, deionized distilled water (DDW) rinsed, screw-capped test tubes were rinsed and then filled with sample water from each integrated sampling depth, capped, stored at 4°C, and later analyzed for total phosphorus using a molybdenum blue method after persulfate digestion. Water samples for the remaining nutrient analyses and chlorophyll determinations were kept cool and dark and filtered within 2-4 h. Water for dissolved nutrient analyses was filtered through 47-mm Whatman GF/F filters, which had been previously ashed (460°C for 4 h). Each filter was placed in a 47-mm Swinnex filtering unit (Millipore Corp.), rinsed with DDW, and then rinsed with approximately 50 mL of sample water. An acid washed, DDW rinsed borosilicate glass bottle was rinsed and filled with 100 mL of filtered water, capped, stored at 4°C in the dark and later analyzed for nitrate (Stainton et al. 1977). An additional 100 mL of sample was filtered into a precleaned and rinsed polyethylene bottle, stored at 4°C in the dark, and later analyzed for soluble reactive silicon and total dissolved solids. A 2-L water sample was filtered through an ashed 47-mm diameter Whatman GF/F filter which was then placed into a clean scintillation vial, and later analyzed for particulate phosphorus using the method of Stainton et al. 1977. 500-mL samples were filtered under subdued light through 47-mm diameter 0.8-μm Millipore AA filters, 2.0-μm Nuclepore filters and 20-μm Nitex filters. These filters were folded in half, placed in aluminum foil dishes, dessicated, and stored frozen until they were macerated in 90% acetone and analyzed for chlorophyll using a Turner fluorometer (Model 112).

At stations where photosynthetic rates (PR) were measured, water for alkalinity determinations was placed in glass bottles which were filled completely (one bottle from each sampling depth) and sealed. A Cole-Parmer Digi-Sense pH meter (Model 5986-10) and Ross combination electrode were used to determine the pH and total alkalinity (mg·L^{-1} $CaCO_3$) of these samples according to the standard potentiometric method of APHA (1980). Dissolved inorganic carbon (DIC) values used in the calculation of PR were established indirectly from pH, temperature, total dissolved solids and bicarbonate alkalinity.

Bacterioplankton numbers were determined by two different methods during the course of the study. From 1985-88 sterile test tubes were rinsed thoroughly with water, and then filled. From each test tube, 5 mL were filtered through a 25-mm diameter, 0.2-µm Nuclepore filter counter-stained with Irgalan black. Filters were removed when just dry, placed in petri dishes lined with absorbent filter paper, and air-dried at room temperature. Bacterioplankton numbers were later determined from these samples using the acridine orange direct count (AODC) method as described by MacIsaac et al. (1981). In 1990, sterile scintillation vials were rinsed thoroughly, and then filled with sample water. Two drops of formaldehyde were added, and bacterioplankton numbers were later determined from these samples using the DAPI method as described by Robarts and Sephton (1981). Comparative tests indicated no significant differences in counts between the AODC and DAPI methods. For each counting method, eight random fields were counted on each filter and the counts converted to numbers·mL^{-1}. Occasional blanks were prepared to check for significant background bacteria counts in the staining solution and rinse water.

Opaque 125-mL polyethylene bottles were rinsed and filled with sample water in the field for phytoplankton enumeration and identification. Phototrophic picoplankton (cyanobacteria and eukaryotic algae <2 µm in diameter) were enumerated using the method described by MacIsaac and Stockner (1985). Fifteen mL of sample water was filtered through stained Nuclepore filters as described for AODC bacteria samples. Care was taken to minimize exposure of the sample to light during sampling and laboratory processing. Filters were placed in opaque petri dishes, air-dried and stored in the dark at room temperature for 1 to 8 months. During analysis, each filter was placed on a wet 40-µm mesh nylon screen in a filter holder, 1-2 mL of filtered DDW were added to the filter column and the cells on the filter were rehydrated for 3-5 min. The water was drawn through at a vacuum pressure of 20 cm Hg, and the moist filter was placed on a glass slide with a drop of immersion oil (Cargille Type B) and a coverslip. The Zeiss epifluorescence microscope used for picoplankton enumeration was equipped with a 397-nm longwave-pass exciter filter and a 560-nm shortwave-pass exciter filter, a 580-nm beam-splitter mirror and a 590-nm longwave-pass barrier filter. Filters were examined at 1250X magnification under oil immersion, and 30 random fields were counted. Phototrophic picoplankton were identified as cyanobacteria or eukaryotic algae, assigned to general categories based on morphological characteristics and fluorescence colour, and scored into size categories.

Water remaining in the opaque polyethylene bottles was fixed with 1-mL of Lugol's iodine solution and phytoplankton >2 µm in diameter were later enumerated and identified from this sample. For analysis, each sample was gently mixed and a subsample settled overnight in a settling chamber of 7-, 12- or 27-mL capacity. Transects at 187.5X and 750X magnification were counted using a Wild M40 inverted microscope equipped with phase contrast optics. Cells were identified to genus or species and assigned to size classes. Total cell numbers for picoplankton (0.2-2.0 µm), nanoplankton (2.0-20 µm) and microplankton (>20 µm) are reported here. Data on phytoplankton species compositon will not be reported here.

At selected stations on the lake PR was measured at discrete depths during 1986, and at three integrated depth intervals during 1987, 1988, and 1990. Depending on the year of sampling, 2-5 125-mL light and 1-3 125-mL dark bottles were filled with water from each discrete or integrated sampling depth. Each bottle was inoculated with approximately 137-kBq of a ^{14}C-bicarbonate stock solution. At each station the activity of the stock solution was determined by inoculating three scintillation vials containing 0.5 mL of Scintigest (Fisher Scientific). Bottles were incubated at their respective depth intervals for 1.5-2 h, generally between 0900 and 1200 h. After incubation, bottles were placed in dark boxes and transported to the field laboratory where filtration started <2 h after incubation stopped. 40-mL aliquots were removed from each bottle and filtered at a vacuum not exceeding 20-cm Hg through 47-mm diameter Nuclepore filters (0.2- and 2.0-µm pore size) and a 47-mm diameter, 20-µm mesh Nitex filter. When just dry, filters were placed into scintillation vials containing 0.5 mL Scintigest (Fisher Scientific). All vials were stored cool in the dark. At the West Vancouver Laboratory, 10 mL of Scintiverse II (Fisher Scientific) was added to each scintillation vial and the samples were counted in a Packard Tri-Carb 4530 liquid scintillation counter. Quench series composed of the same scintillation cocktail and filters as used for samples were used to determine counting efficiency and Strickland's (1960) equation was used to calculate PR. PR was converted from hourly to daily rates using light data collected with Li-Cor printing integrators (Model 550) equipped with Model 190S quantum sensors, or Li-Cor Dataloggers (Model LI-1000) equipped with LI 190SA quantum sensors.

RESULTS

A variety of summary and raw data tables are presented for each year and station, along with selected temperature and fluorometer data. Epilimnetic values for biological and chemical data are presented as depth-weighted means, while biological and chemical data from discrete profiles carried out at station 8 in 1990 are presented as raw data. A variety of physical variables are also presented for each station and date. Seasonal averages for each station and seasonal whole-lake averages are also presented. Seasonal averages for each station were calculated as time-weighted means of epilimnetic data obtained during the growing season (defined as May 1-October 31). Seasonal means for stations within each major basin of Quesnel Lake were averaged, weighted by the area of the basin, and then summed to yield whole-lake averages. (Stations 2, 3 and 6 were not sampled each year and were therefore not included in the determination of annual whole-lake averages). Due to the fewer number of stations where PR was measured, simple means of seasonal averages were used in calculating a whole-lake estimate of PR.

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LIST OF TABLES

Table 1. Legend for Table 2.

Symbol	Description
A	Physical variables (surface temperature, Secchi depth, light profile to compensation depth)
B	Temperature profile (CTD or STD) to a maximum depth of 200 m
C	Nitrate, total phosphorus, total dissolved solids, silica
D	Particulate phosphorus
E	Total chlorophyll
F	Fractionated and/or discrete chlorophyll
G	Picoplankton and phytoplankton identification and enumeration
H	Bacteria biomass
I	pH, total alkalinity and dissolved inorganic carbon
J	Photosynthetic rate
K	*In vivo* fluorometer profile

Table 2. Biological, chemical and physical variables measured during the study.

Year	Station	Variables measured	Depths sampled (m)	Number of sampling dates
1985	1	A,B,C,D,E,G,H,I	1,3,5,40	7
	2	A,B,C,D,E,G,H,I	1,3,5,40	7
	4	A,B,C,D,E,G,H	1,3,5,40	7
	5	A,B,C,D,E,G,H,I	1.3.5.40	7
	6	A,B,C,D,E,G,H	1,3,5,40	7
	7	A,B,C,D,E,G,H	1,3,5,40	7
	8	A,B,C,D,E,G,H	1,3,5,40	7
	9	A,B,C,D,E,G,H,I	1,3,5,40	7
1986	1	A,B,C,D,E,G,H,K	1,5,10,40	6
	4	A,B,C,D,E,G,H,K	1,5,10,40	6
	5	A,B,C,D,E,G,H,K	1,5,10,40	6
	6	A,B,C,D,E,G,H,K	1,5,10,40	6
	7	A,B,C,D,E,G,H,I,J,K	variable	6
	8	A,B,C,D,E,G,H,I,J,K	variable	6
	9	A,B,C,D,E,G,H,K	1,5,10,40	6
1987	1	A,B,C,D,E,F,G,H,K	variable	6
	4	A,B,C,D,E,F,G,H,K	variable	6
	5	A,B,C,D,E,F,G,H,K	variable	6
	6	A,B,C,D,E,F,G,H,K	variable	6
	7	A,B,C,D,E,F,G,H,I,J,K	variable	6
	8	A,B,C,D,E,F,G,H,I,J,K	variable	6
	9	A,B,C,D,E,F,G,H,K	variable	6
1988	1	A,B,C,D,E,F,G,H,I,J,K	variable	6
	3	A,B,C,D,E,F,G,H,I,J,K	variable	6
	4	A,B,C,D,E,F,G,H,I,J,K	variable	6
	5	A,B,C,D,E,F,G,H,I,J,K	variable	6
	7	A,B,C,D,E,F,G,H,I,J,K	variable	6
	9	A,B,C,D,E,F,G,H,I,J,K	variable	6

Table 2. Biological, chemical and physical variables measured during the study.

Year	Station	Variables measured	Depths sampled (m)	Number of sampling dates
1990	1	A,B,C,D,E,F,G,H,K	variable	6
	3	A,B,C,D,E,F,G,H,I,J,K	variable	6
	4	A,B,C,D,E,F,G,H,K	variable	6
	5	A,B,C,D,E,F,G,H,K	variable	6
	7	A,B,C,D,E,F,G,H,I,J,K	variable	6
	8	A,B,C,D,E,F,G,H,I,J,K	variable	6
	8.1	A,B,K	variable	6
	9	A,B,C,D,E,F,G,H,I,J,K	variable	6

Table 3. Variation in physical data for each station.

Year and Station	Date	Surface temp. (°C)	Mean epil. temp. (°C)	Therm. depth (m)	Euphotic zone depth (m)	Ext. coeff. (·m^{-1})	Secchi depth (m)
1985							
1	08MAY	3.3	3.5		13.0	0.33	10.0
	05JUN	6.7	9.5	10.4	9.0	0.48	5.5
	04JUL	14.2	15.2	2.0	10.4	0.42	7.0
	31JUL	19.1	18.6	2.9	14.0	0.31	10.0
	28AUG	15.6	16.5	10.0	14.3	0.29	12.0
	25SEP	10.3	9.4	24.2	16.4	0.23	8.0
	23OCT	5.9	7.9		14.6	0.27	10.5
2	08MAY	3.0	3.0		16.6	0.25	13.5
	05JUN	10.4	9.2	3.0	8.8	0.49	4.2
	04JUL	15.2	14.5	4.5	12.1	0.37	8.0
	31JUL	19.2	18.9	5.7	13.9	0.31	10.0
	28AUG	16.8	16.7	14.7	16.8	0.25	11.5
	25SEP	11.2	9.9	29.3	17.8	0.24	12.5
	23OCT	7.8	7.8		12.2	0.36	13.5
4	08MAY	3.3	3.3		20.4	0.20	17.5
	05JUN	7.2	6.3	9.0	13.4	0.33	10.0
	04JUL	17.0	14.2	9.6	12.4	0.35	11.0
	31JUL	19.9	19.5	9.7	12.5	0.36	9.0
	28AUG	17.2	16.5	15.4	14.6	0.29	10.0
	25SEP	10.7	8.8	32.2	15.8	0.24	12.8
	23OCT	7.3	7.1	15.0	22.0	0.20	10.5
5	07MAY	2.7	2.4		18.6	0.22	15.5
	04JUN	10.2	9.5	4.5	8.2	0.53	4.0
	03JUL	16.0	13.9	6.4	12.0	0.37	7.0
	30JUL	19.7	19.4	5.7	14.5	0.30	9.0
	27AUG	16.7	16.6	13.3	16.7	0.26	11.0
	24SEP	12.0	11.0	10.4	11.9	0.31	8.1
	22OCT	7.8	7.7		13.1	0.35	12.0
6	07MAY	3.3	3.2		19.8	0.21	14.0
	04JUN	6.7	6.5	3.5	12.7	0.34	10.0
	03JUL	14.2	13.4	5.0	9.7	0.45	6.5

Table 3. Variation in physical data for each station.

Year and Station	Date	Surface temp. (°C)	Mean epil. temp. (°C)	Therm. depth (m)	Euphotic zone depth (m)	Ext. coeff. (·m^{-1})	Secchi depth (m)
1985							
6	30JUL	19.1	19.1	6.2	7.1	0.69	4.5
	27AUG	15.6	15.6	20.0	7.4	0.55	2.8
	24SEP	10.3	9.6	18.7	15.2	0.27	7.5
	22OCT	5.9	5.8	21.7	13.3	0.32	8.0
7	08MAY	3.1	3.1		14.0	0.30	11.0
	05JUN	10.1	10.0	5.0	5.5	0.75	2.0
	04JUL	17.0	16.3	3.5	8.7	0.44	5.0
	31JUL	20.4	20.3	3.4	13.8	0.32	11.0
	28AUG	16.2	16.2	12.8	15.5	0.28	11.0
	25SEP	11.2	9.5	32.0	15.1	0.28	10.0
	23OCT	8.2	8.1		15.0	0.29	12.5
8	07MAY	3.1	2.8		19.8	0.22	16.0
	04JUN	10.8	10.1	2.5	10.6	0.41	10.8
	03JUL	15.5	15.1	9.4	12.5	0.35	7.5
	30JUL	19.5	18.8	14.8	14.6	0.30	11.5
	27AUG	16.9	16.6	11.6	15.0	0.28	12.0
	24SEP	11.5	10.0	20.0	15.9	0.26	11.5
	22OCT	8.0	7.9		15.3	0.28	14.0
9	07MAY	4.0	3.3		21.3	0.19	18.0
	04JUN	5.7	5.6	3.0	17.2	0.25	11.0
	03JUL	15.5	14.0	9.6	12.6	0.36	9.5
	30JUL	19.4	19.2	12.6	11.9	0.36	7.0
	27AUG	16.7	16.7	19.3	13.3	0.31	7.0
	24SEP	11.0	10.1	22.0	15.0	0.28	11.0
	22OCT	5.9	5.8	19.2	18.4	0.24	13.0
1986							
1	14MAY	4.7	4.2		14.1	0.31	9.0
	24JUN	13.5	10.1	16.7			5.0
	22JUL	19.4	15.3	13.9	14.8	0.30	9.0
	26AUG	17.3	16.5	16.0	14.9	0.28	10.8
	24SEP	12.7	12.4	25.0	19.2	0.22	13.0

Table 3. Variation in physical data for each station.

Year and Station	Date	Surface temp. (°C)	Mean epil. temp. (°C)	Therm. depth (m)	Euphotic zone depth (m)	Ext. coeff. (·m^{-1})	Secchi depth (m)
1986							
1	18OCT	10.4	10.5	20.8	14.2	0.28	15.5
4	15MAY	4.3	3.6		22.3	0.19	19.5
	25JUN	12.8	9.4	2.6	14.3	0.30	7.0
	23JUL	16.8	16.4	7.3	15.0	0.28	12.5
	27AUG	18.6	17.8	15.0	15.4	0.29	10.5
	24SEP	11.8	11.3	28.9	18.4	0.23	9.8
	17OCT	9.8	8.6		14.0	0.30	12.3
5	15MAY	4.8	3.5		17.8	0.25	20.0
	26JUN	11.6	9.4	16.7	12.2	0.36	8.0
	24JUL	15.9	14.2	10.2	15.3	0.28	9.4
	27AUG	17.8	17.6	10.6	16.5	0.25	10.5
	24SEP	13.2	13.2	14.0	17.5	0.24	11.2
	17OCT	10.3	10.3	34.6	17.6	0.24	12.0
6	15MAY	4.3	3.8		22.6	0.19	17.0
	25JUN	8.9	6.0		13.6	0.32	4.7
	23JUL	15.6	15.3	9.1	11.7	0.37	7.2
	27AUG	16.8	16.5	10.8	11.6	0.36	6.0
	24SEP	12.1	11.4	5.4	17.1	0.26	6.2
	16OCT	6.2	5.1		12.7	0.31	14.0
7	14MAY	4.0	3.7		15.8	0.27	12.3
	24JUN	12.8	9.5	11.1	8.8	0.48	6.1
	22JUL	19.9	15.2	13.0	12.1	0.37	7.8
	26AUG	17.5	16.7	14.5	14.3	0.29	10.0
	23SEP	13.2	13.1	22.0	19.1	0.20	10.2
	18OCT	10.4	10.4	20.3	16.9	0.25	9.5
8	16MAY	3.8	3.6		22.3	0.19	13.0
	26JUN	12.8	8.5	7.1	8.8	0.48	6.8
	24JUL	15.3	12.7	11.2	13.5	0.32	11.2
	28AUG	17.8	17.6	12.9	16.3	0.26	11.0
	25SEP	12.7	12.7	22.8	17.4	0.24	10.8
	17OCT	10.4	10.2	18.5	12.9	0.31	11.2

Table 3. Variation in physical data for each station.

Year and Station	Date	Surface temp. (°C)	Mean epil. temp. (°C)	Therm. depth (m)	Euphotic zone depth (m)	Ext. coeff. (·m^{-1})	Secchi depth (m)
1986							
9	15MAY	4.2	3.7		24.9	0.17	18.0
	25JUN	9.8	7.2		15.1	0.28	7.3
	23JUL	17.2	15.9	11.7	17.6	0.23	11.0
	27AUG	17.8	17.1	15.9	15.3	0.29	9.0
	24SEP	11.4	10.8	14.4	16.0	0.26	9.5
	16OCT	9.4	7.9		11.7	0.32	
1987							
1	21MAY	7.8	5.8		14.5	0.29	11.8
	23JUN	13.7	12.7	17.0			8.1
	21JUL	16.7	15.4	8.0	16.9	0.25	10.2
	19AUG	14.4	14.3	9.0	17.7	0.23	10.0
	16SEP	14.6	14.7	17.1	21.7	0.20	14.0
	21OCT	10.7	10.6	23.5	14.8	0.29	16.0
4	22MAY	7.4	6.6		14.9	0.30	9.0
	25JUN	15.8	12.8				12.0
	23JUL	18.4	16.6	11.9	16.1	0.27	9.8
	20AUG	15.9	15.7	16.1	16.1	0.26	11.2
	15SEP	15.2	14.8	20.3	19.7	0.21	9.5
	22OCT	11.0	10.3	20.8	18.3	0.23	12.8
5	20MAY	6.8	5.7		14.6	0.29	10.2
	24JUN	13.2	12.7	6.8			
	22JUL	17.6	17.4	6.8	16.2	0.26	9.3
	18AUG	16.2	5.5	10.0	16.3	0.25	10.5
	17SEP	14.7	14.7	12.2	18.6	0.22	14.1
	22OCT	11.0		20.0	18.9	0.20	13.2
6	22MAY	5.8	5.4		19.8	0.21	13.5
	25JUN	11.0	10.6	16.1			3.5
	23JUL	16.3	15.6	10.3	9.7	0.44	4.8
	20AUG	15.2	15.2	9.2	12.2	0.35	4.5
	15SEP	14.5	14.7	13.6	13.8	0.31	4.5
	22OCT	8.8	8.7	22.6	13.0	0.29	9.8

Table 3. Variation in physical data for each station.

Year and Station	Date	Surface temp. (°C)	Mean epil. temp. (°C)	Therm. depth (m)	Euphotic zone depth (m)	Ext. coeff. (·m^{-1})	Secchi depth (m)
1987							
7	21MAY	7.7	6.2		10.1	0.39	7.7
	23JUN	13.5	13.4	9.4	11.2	0.37	5.0
	21JUL	17.0	16.8	5.9	16.3	0.25	10.3
	19AUG	15.2	14.1	19.0	16.4	0.25	12.4
	16SEP	14.7	14.4	14.4	14.1	0.29	9.0
	21OCT	10.9	10.9	24.4	13.8	0.29	12.5
8	20MAY	6.3	5.4		13.2	0.32	10.6
	24JUN	13.1	12.6	6.8	13.9	0.30	9.2
	22JUL	16.7	15.2	13.0	14.9	0.28	8.8
	18AUG	16.1	15.8	11.7	17.8	0.24	12.5
	17SEP	14.7	13.7	16.8	15.2	0.25	11.0
	20OCT	11.1	10.9	16.3	16.7	0.24	11.5
9	22MAY	7.1	6.2		16.9	0.25	9.8
	25JUN	14.1	11.4				7.9
	23JUL	17.7	16.5	8.5	14.1	0.30	8.3
	20AUG	20.8	15.5	13.6	16.3	0.26	8.5
	15SEP	15.3	15.0	11.7	20.7	0.22	9.8
	22OCT	10.0	9.8	20.0	16.1	0.26	11.2
1988							
1	10MAY	7.2	5.2		15.9	0.27	9.0
	07JUN	10.4	9.4		9.6	0.47	6.1
	12JUL	15.8	13.5	4.4	16.3	0.27	8.0
	16AUG	16.7	16.1	8.1	18.6	0.23	11.0
	14SEP	15.6	14.9	15.6	16.3	0.24	14.5
	11OCT	11.8	11.8	13.2	15.9	0.24	16.5
3	11MAY	6.3	5.7		16.7	0.26	15.5
	08JUN	9.2	9.1	10.5	15.5	0.28	9.2
	13JUL	14.9	14.4	9.5	18.8	0.23	9.5
	17AUG	15.5	15.9	12.6	17.2	0.23	10.2
	15SEP	15.3	15.1	14.7	18.4	0.22	11.5
	12OCT	12.0	11.7	12.6	19.7	0.23	14.8

Table 3. Variation in physical data for each station.

Year and Station	Date	Surface temp. (°C)	Mean epil. temp. (°C)	Therm. depth (m)	Euphotic zone depth (m)	Ext. coeff. (·m^{-1})	Secchi depth (m)
1988							
4	09JUN	9.6	8.7	5.3	20.9	0.21	10.8
	14JUL	12.5	12.3	8.4	16.0	0.27	9.0
	18AUG	17.0	15.4	11.3	14.1	0.30	8.0
	16SEP	15.0	14.9	15.0	18.2	0.23	11.4
	13OCT	11.9	11.8	18.9	14.3	0.26	13.8
5	11MAY	9.9	6.9	3.2	18.1	0.24	9.0
	08JUN	9.5	9.7	18.4	13.1	0.32	7.3
	13JUL	15.5	15.1	12.1	14.6	0.29	9.0
	17AUG	16.4	16.2	9.4	17.6	0.23	11.3
	15SEP	15.4	15.0	13.8	19.6	0.21	11.0
	12OCT	12.0	12.0	11.6	16.5	0.24	14.5
7	10MAY	10.2	6.0	2.1	5.9	0.70	3.2
	07JUN	10.4	8.7	2.1	8.7	0.44	3.6
	12JUL	14.9	11.9	4.2	13.9	0.30	8.8
	16AUG	16.5	16.8	10.5	18.6	0.23	10.8
	14SEP	15.3	14.9	13.2	18.1	0.24	12.4
	11OCT	11.9	11.9	13.7	19.1	0.21	15.4
9	12MAY	5.9	4.8		23.0	0.19	12.0
	09JUN	8.9	8.2	5.8	16.7	0.23	9.3
	14JUL	12.5	12.1	8.4	16.3	0.25	8.5
	18AUG	15.6	15.0	6.3	12.6	0.36	5.0
	16SEP	14.3	14.6	16.3	18.1	0.22	10.5
	13OCT	11.9	11.5	12.1	18.4	0.21	12.0
1990							
1	17MAY	7.3	6.2	2.6	13.3	0.31	9.5
	20JUN	9.2	7.8	6.0	14.2	0.31	8.0
	20JUL	15.3	13.3	8.0	10.4	0.40	7.5
	24AUG	14.8	12.6	8.2	14.2	0.31	8.5
	20SEP	15.3	15.3	9.4	17.8	0.24	12.5
	26OCT	7.3	7.9		12.7	0.32	12.5
3	18MAY	6.0	5.4	3.1	18.0	0.21	12.5

Table 3. Variation in physical data for each station.

Year and Station	Date	Surface temp. (°C)	Mean epil. temp. (°C)	Therm. depth (m)	Euphotic zone depth (m)	Ext. coeff. (·m^{-1})	Secchi depth (m)
1990							
3	21JUN	12.4	10.5	1.8	10.7	0.39	8.0
	19JUL	16.2	16.1	9.0	11.5	0.37	7.3
	23AUG	19.3	19.2	14.2	17.6	0.25	9.5
	19SEP	16.1	16.3	13.0	18.8	0.23	11.0
	25OCT	8.4	8.5		10.3	0.42	11.5
4	18MAY	6.6	5.8	3.1	20.4	0.20	14.0
	22JUN	11.5	10.5	1.6	8.1	0.52	4.5
	18JUL	16.5	16.2	11.9			7.0
	22AUG	20.5	19.6	9.3	15.8	0.23	9.5
	21SEP	16.5	16.0	13.9	16.8	0.25	13.0
	24OCT	7.4	7.5		17.7	0.23	9.0
5	18MAY	8.4	7.2	6.5	13.6	0.30	5.5
	21JUN	14.5	11.3	1.2	12.6	0.34	6.5
	19JUL	16.8	16.1	8.7	10.0	0.44	5.8
	23AUG	19.6	19.5	11.0	16.7	0.26	8.5
	19SEP	16.4	16.5	16.5	16.1	0.26	10.5
	25OCT	8.7	8.8	27.8	15.1	0.27	10.0
7	17MAY	9.7	8.2		5.1	0.81	2.5
	20JUN	11.2	9.3	4.0	3.9	0.97	1.5
	20JUL	15.0	14.6	9.7	8.5	0.50	6.8
	24AUG	16.6	16.5	9.5	12.4	0.34	8.5
	20SEP	15.5	15.4	11.0	13.7	0.31	10.5
	26OCT	8.3	8.3		11.2	0.36	9.5
8	16MAY	4.6	4.1		20.7	0.20	17.0
	19JUN	13.4	9.5	10.5	4.2	1.04	1.0
	17JUL	16.8	16.0	10.4	9.0	0.45	6.0
	21AUG	20.2	19.2	8.0	13.4	0.31	10.0
	18SEP	16.3	16.3	11.6	17.5	0.24	12.0
	23OCT	8.3	8.4		15.6	0.26	9.5
8.1	16MAY	7.3	5.5				7.5
	19JUN	12.7	10.5	5.5			1.0

Table 3. Variation in physical data for each station.

Year and Station	Date	Surface temp. (°C)	Mean epil. temp. (°C)	Therm. depth (m)	Euphotic zone depth (m)	Ext. coeff. ($\cdot m^{-1}$)	Secchi depth (m)
1990							
8.1	17JUL	17.2	15.9	8.8	9.9	0.42	6.0
	21AUG	21.5	19.5	8.0	16.8	0.27	9.5
	18SEP	16.2	16.1	10.6	16.0	0.27	11.8
	23OCT	8.3	8.4		16.3	0.25	9.5
9	17MAY	4.1	4.0		21.5	0.19	17.0
	22JUN	10.9	10.4	7.0	9.4	0.45	5.0
	18JUL	16.1	15.9	15.0			7.5
	22AUG	20.0	19.4	9.2	15.3	0.28	8.5
	21SEP	15.5	15.5	15.9	18.2	0.23	11.0
	24OCT	6.3	6.3		18.0	0.25	9.5

Table 4. Variation in mean epilimnetic chemical data for each station.

Year and Station	Date	Nitrate ($\mu g\ N \cdot L^{-1}$)	Total P ($\mu g\ P \cdot L^{-1}$)	Part. P ($\mu g\ P \cdot L^{-1}$)	Silica ($mg\ Si \cdot L^{-1}$)	T.D.S. ($mg \cdot L^{-1}$)
1985						
1	08MAY	100.7	0.9	1.7	1.64	73
	05JUN	93.0	4.3	1.0	1.42	63
	04JUL	63.3	3.0	1.8	1.41	56
	31JUL	55.3	3.3	0.7	1.46	68
	28AUG	46.7	2.0	1.0	1.52	64
	25SEP	69.3	2.0	1.2	1.33	61
	23OCT	80.0	2.0	0.8	1.33	62
2	08MAY	110.7	0.9	1.1	1.56	97
	05JUN	100.3	4.0	4.9	1.32	61
	04JUL	63.3	4.0	2.3	1.35	60
	31JUL	56.7	2.3	0.9	1.51	56
	28AUG	49.7	2.0	0.7	1.42	58
	25SEP	66.0	2.0	1.1	1.25	64
	23OCT	85.0	2.0	0.6	1.32	59
4	08MAY	115.3	0.9	0.8	1.51	75
	05JUN	104.3	1.7	3.1	1.25	64
	04JUL	78.3	2.7	1.8	1.39	61
	31JUL	60.0	0.9	0.7	1.49	60
	28AUG	48.3	1.3	0.7	1.52	68
	25SEP	73.7	2.3	1.4	1.20	66
	23OCT	95.3	2.0	0.6	1.37	60
5	07MAY	111.7	0.9	1.0	1.46	92
	04JUN	106.7	3.3	2.1	0.90	65
	03JUL	65.3	2.0	1.2	0.94	58
	30JUL	54.3	1.7	0.9	1.10	57
	27AUG	51.0	2.0	0.9	1.32	56
	24SEP	61.3	2.7	1.2	1.17	65
	22OCT	85.7	2.3	0.5	1.27	60
6	07MAY	115.7	0.9	0.8	1.49	
	04JUN	107.3	2.0	1.4	1.26	69
	03JUL	86.5	2.3	2.6	1.31	62
	30JUL	73.0	3.7	2.2	1.48	66

Table 4. Variation in mean epilimnetic chemical data for each station.

Year and Station	Date	Nitrate (µg N·L^{-1})	Total P (µg P·L^{-1})	Part. P (µg P·L^{-1})	Silica (mg Si·L^{-1})	T.D.S. (mg·L^{-1})
1985						
6	27AUG	67.0	2.7	1.8	1.47	74
	24SEP	79.7	2.7	1.3	1.08	65
	22OCT	107.0	2.3	0.5	1.39	62
7	08MAY	105.0	0.9	1.6	1.58	67
	05JUN	61.3		3.7	1.59	57
	04JUL	44.0	3.7	2.6	1.53	57
	31JUL	54.0	3.7	0.8	1.51	63
	28AUG	49.3	1.3	0.7	1.46	46
	25SEP	69.7	3.0	1.7	1.29	60
	23OCT	81.0	2.3	0.9	1.31	62
8	07MAY	111.3	0.9	0.9	1.51	84
	04JUN	94.3	4.7	2.0	1.31	58
	03JUL	70.7	2.3	1.4	1.18	58
	30JUL	59.7	0.9	0.7	1.41	63
	27AUG	53.3	2.0	0.7	1.36	59
	24SEP	62.7	2.3	1.0	1.16	
	22OCT	85.0	2.0	0.5	1.33	59
9	07MAY	115.7	0.9	0.7	1.48	96
	04JUN	112.3	2.7	1.4	1.30	62
	03JUL	78.7	1.6	2.1	1.27	62
	30JUL	65.7	1.7	1.0	1.50	62
	27AUG	52.3	1.7	1.0	1.41	61
	24SEP	74.7	2.3	1.3	1.14	64
	22OCT	113.0	2.0	0.6	1.39	60
1986						
1	14MAY	107.7	3.3	1.7		68
	24JUN	73.0	4.3	2.4		30
	22JUL	52.7	2.7	1.9		59
	26AUG	51.0	0.9	0.9		59
	24SEP	57.0	2.3	1.1		58
	18OCT	62.7	3.0	1.0		66
4	15MAY	127.7	2.3	0.8		58

Table 4. Variation in mean epilimnetic chemical data for each station.

Year and Station	Date	Nitrate (μg N·L^{-1})	Total P (μg P·L^{-1})	Part. P (μg P·L^{-1})	Silica (mg Si·L^{-1})	T.D.S. (mg·L^{-1})
1986						
4	25JUN	88.3	3.3	2.4		63
	23JUL	68.0	1.3	1.3		56
	27AUG	52.7	1.3	0.6		57
	24SEP	42.7	2.0	1.1		85
	17OCT	69.7	2.7	0.5		47
5	15MAY	122.7	2.3	1.0		58
	26JUN	83.0	3.0	1.9		56
	24JUL	64.7	1.6	1.0		51
	27AUG	46.7	1.3	0.5		54
	25SEP	35.0	1.7	1.0		51
	17OCT	60.3	2.0	0.6		50
6	15MAY	127.7	2.3	0.7		60
	25JUN	116.0	2.0	2.3		65
	23JUL	75.0	2.3	1.5		57
	27AUG	46.7	1.7	0.9		55
	24SEP	43.7	2.3	1.4		86
	16OCT	43.7	1.7	0.6		53
7	14MAY	120.2	3.2	1.6		63
	24JUN	73.0	4.0	3.1		56
	22JUL	61.5	3.3	2.0		
	26AUG	55.5	0.9	1.1		68
	23SEP	51.5	1.7	1.5		60
	18OCT	59.3	3.8	0.9		
8	16MAY	122.6	2.8	0.9		57
	26JUN	83.5	4.3	3.0		55
	24JUL	80.0	2.3	1.8		
	28AUG	67.8	1.5	0.8		53
	25SEP	51.5	2.0	1.0		60
	17OCT	65.5	3.7	0.7		
9	15MAY	126.3	2.0	0.6		59
	25JUN	103.0	3.3	2.0		62
	23JUL	68.3	1.3	1.3		59

Table 4. Variation in mean epilimnetic chemical data for each station.

Year and Station	Date	Nitrate ($\mu g\ N{\cdot}L^{-1}$)	Total P ($\mu g\ P{\cdot}L^{-1}$)	Part. P ($\mu g\ P{\cdot}L^{-1}$)	Silica ($mg\ Si{\cdot}L^{-1}$)	T.D.S. ($mg{\cdot}L^{-1}$)
1986						
9	27AUG	43.3	0.9	0.5		61
	24SEP	39.3	2.3	1.2		70
	16OCT	77.0	3.0	0.6		53
1987						
1	21MAY	96.5	1.5	0.5	1.89	63
	23JUN	74.5	5.3	5.1	2.04	69
	21JUL	68.5	3.3	0.8	1.72	61
	19AUG	61.0	1.8	1.8	1.63	55
	16SEP	44.0	2.3	1.7	1.79	60
	21OCT	47.5	3.3	2.1	1.42	
4	22MAY	121.5	2.8	0.7	1.66	67
	25JUN	76.5	3.3	3.8	1.80	73
	23JUL	68.0	3.0	0.9	1.79	59
	20AUG	46.5	2.3	2.3	1.52	89
	15SEP	46.5	2.3	1.2	1.61	59
	22OCT	66.5	2.3	4.6	1.44	
5	20MAY		2.3	0.4	1.86	61
	24JUN	76.5	3.0	3.8	1.64	68
	22JUL	70.0	3.0	0.8	1.69	59
	18AUG	50.0	2.0	2.0	1.42	68
	17SEP	47.5	2.5	2.1	1.61	48
	22OCT	59.0	2.0	4.3	1.48	
6	22MAY	140.8	3.3	0.4	1.76	71
	25JUN	104.5	3.8	1.2	1.78	64
	23JUL	71.0	4.0	1.3	1.60	73
	20AUG	43.5	2.3	2.9	1.46	71
	15SEP	46.5	2.5	2.4	1.44	61
	22OCT	87.5	2.5	4.1	1.55	
7	21MAY	100.8	3.3	0.5	1.74	68
	23JUN	67.0	4.7	4.7	1.93	64
	21JUL	60.3	3.2	0.9	1.71	67
	19AUG	55.0	2.0	1.5	1.62	69

Table 4. Variation in mean epilimnetic chemical data for each station.

Year and Station	Date	Nitrate (µg N·L^{-1})	Total P (µg P·L^{-1})	Part. P (µg P·L^{-1})	Silica (mg Si·L^{-1})	T.D.S. (mg·L^{-1})
1987						
7	16SEP	45.3	1.7	1.9	1.77	60
	21OCT	52.0	2.0	1.6	1.40	
8	20MAY	115.5	3.5	0.6	1.83	60
	24JUN	86.3	3.8	4.6	1.84	69
	22JUL	65.0	3.5	1.0	1.71	63
	18AUG	57.0	2.0	1.6	1.56	75
	17SEP	54.7	1.2	2.0	1.69	48
	20OCT	60.0	2.7	2.0	1.45	
9	22MAY	132.0	2.0	0.5		
	25JUN	95.5	4.3	3.9	1.78	47
	23JUL	69.5	3.0	0.9	1.70	68
	20AUG	44.5	2.0	2.4	1.50	76
	15SEP	49.0	1.0	1.5	1.46	63
	22OCT	87.5	2.0	4.0	1.44	
1988						
1	10MAY	67.7	2.5	1.5	1.82	60
	07JUN	42.3	5.3	3.5	2.00	60
	12JUL	53.6	2.5	3.2	1.70	69
	16AUG	49.6	1.5	1.8	1.64	51
	14SEP	34.2	2.4	0.2	2.22	55
	11OCT	66.3	4.1	1.5	2.84	47
3	11MAY	101.5	1.5	0.9	1.80	56
	08JUN	54.9	3.6	1.5	1.73	57
	13JUL	50.1	2.3	2.4	1.48	68
	17AUG	40.9	2.0	1.3	1.52	80
	15SEP	35.4	1.1	0.5	2.09	71
	12OCT	65.3	4.5	1.6	2.76	53
4	09JUN	58.6	2.1	1.4	1.84	67
	14JUL	52.8	2.2	2.6	1.62	65
	18AUG	40.8	1.7	1.9	1.52	63
	16SEP	33.8	2.2	0.3	2.21	67
	13OCT	71.5	3.5	1.3	2.81	57

Table 4. Variation in mean epilimnetic chemical data for each station.

Year and Station	Date	Nitrate (µg N·L^{-1})	Total P (µg P·L^{-1})	Part. P (µg P·L^{-1})	Silica (mg Si·L^{-1})	T.D.S. (mg·L^{-1})
1988						
5	11MAY	96.0	2.0	1.2	1.78	59
	08JUN	59.0	2.3	1.8	1.63	68
	13JUL	46.5	2.2	2.8	1.34	53
	17AUG	41.2	1.7	1.8	1.47	100
	15SEP	49.0	1.1	0.8	2.13	76
	12OCT	71.5	4.9	1.6	2.73	59
7	10MAY	64.9	4.7	2.9	2.92	56
	07JUN	40.8	3.8	3.8	2.15	68
	12JUL	49.0	2.5	3.3	1.73	65
	16AUG	38.1	1.7	1.7	1.68	63
	14SEP	45.5	2.2	0.4	2.26	72
	11OCT	68.5	6.4	1.9	2.90	64
9	12MAY	93.9	1.7	0.8	1.81	24
	09JUN	56.1	2.7	1.6	1.87	
	14JUL	54.8	2.4	2.3	1.63	60
	18AUG	42.6	2.3	3.9	1.49	60
	16SEP	46.6	1.1	1.0	2.18	57
	13OCT	79.6	3.7	1.8	2.83	63
1990						
1	17MAY	120.5	3.3	2.1	2.05	69
	20JUN	101.0	2.7	2.3	1.49	68
	20JUL	73.0	3.6	2.8	1.52	63
	24AUG	86.3	2.6	1.5	1.78	52
	20SEP	79.3	3.9	1.2	1.63	63
	26OCT	88.2	7.4	1.4	1.70	57
3	18MAY	133.5	2.2	1.4	1.97	72
	21JUN	104.9	2.6	1.7	1.48	57
	19JUL	70.0	3.0	2.0	1.05	61
	23AUG	56.0	2.6	1.3	2.34	39
	19SEP	66.1	3.3	1.4	1.36	64
	25OCT	97.4	5.1	1.3	1.68	59
4	18MAY	134.0	2.1	1.5	1.78	83

Table 4. Variation in mean epilimnetic chemical data for each station.

Year and Station	Date	Nitrate (μg N·L^{-1})	Total P (μg P·L^{-1})	Part. P (μg P·L^{-1})	Silica (mg Si·L^{-1})	T.D.S. (mg·L^{-1})
1990						
4	22JUN	101.1	5.7	4.5	1.54	56
	18JUL	68.0	3.1	2.7	1.42	67
	22AUG	59.6	2.6	1.1	1.53	48
	21SEP	56.9	2.3	1.0	1.91	60
	24OCT	103.3	4.2	1.0	1.79	61
5	18MAY	139.5	2.7	2.7	1.65	85
	21JUN	107.0	2.4	1.7	2.50	68
	19JUL	58.8	4.4	2.4	1.01	63
	23AUG	47.6	2.3	1.2	1.43	68
	19SEP	50.6	3.2	1.2	1.66	81
	25OCT	81.9	4.1	1.5	1.67	57
7	17MAY	98.8	6.9	4.4	2.79	69
	20JUN	79.5	2.9	8.4		
	20JUL	57.7	5.2	2.9	1.51	65
	24AUG	60.5	2.8	1.4	1.85	63
	20SEP	81.8	4.3	1.3	1.67	96
	26OCT	86.3	4.1	1.3	1.76	49
8	16MAY	123.0	2.2	0.9	1.61	69
	19JUN	90.8	4.6	6.4	1.65	68
	17JUL	67.8	4.7	1.8	1.45	67
	21AUG	81.9	3.0	1.4	1.61	60
	18SEP	80.5	5.1	1.0	1.41	59
	23OCT	88.1	4.3	1.2	1.76	51
9	17MAY	127.2	3.5	0.9	1.84	85
	22JUN	87.4	4.6	9.3	1.42	59
	18JUL	69.9	2.9	2.5	1.45	61
	22AUG	96.7	2.3	1.3	1.91	68
	21SEP	70.3	3.2	0.9	1.62	60
	24OCT	121.6	3.0	1.0	1.88	61

Table 5. Variation in mean epilimnetic biological data for each station.

Year and Station	Date	Bacteria ($x10^6 \cdot mL^{-1}$)	Chlorophyll ($\mu g \cdot L^{-1}$)				Phytoplankton ($Numbers \cdot mL^{-1}$)		
			Total	Pico.	Nano.	Micro.	Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1985									
1	08MAY	0.93	0.79				1.32	1.52	4.94
	05JUN	1.25	2.33				2.35	5.64	10.51
	04JUL	0.62	0.81				2.05	3.25	6.21
	31JUL	0.45	1.03				2.86	2.19	4.71
	28AUG	0.97	0.89				0.88	1.17	5.30
	25SEP	0.89	1.57				2.52	1.80	4.13
	23OCT	0.72	1.53				2.35	1.77	4.88
2	08MAY	0.91	0.60				0.91	1.53	6.12
	05JUN	1.31	1.57				1.63	4.24	9.44
	04JUL	0.55	0.79				4.35	2.80	5.15
	31JUL	0.48	0.81				3.45	1.72	3.06
	28AUG	0.66	1.10				2.18	1.39	7.47
	25SEP	0.70	1.77				2.28	1.34	9.60
	23OCT	0.63	1.23				1.86	1.23	4.91
4	08MAY	0.62	0.59				0.87	0.99	3.55
	05JUN	0.70	0.75				1.52	2.06	5.37
	04JUL	0.71	0.54				4.95	2.41	3.94
	31JUL	0.67	0.65				5.23	1.78	3.38
	28AUG	0.63	1.18				2.44	1.75	4.69
	25SEP	0.36	1.32				2.17	1.30	6.63
	23OCT	0.88	1.03				1.02	0.81	4.85
5	07MAY	0.60	0.68				1.65	1.81	4.91
	04JUN	1.06	1.85				1.10	3.70	10.47
	03JUL	0.66	0.73				3.69	4.35	11.80
	30JUL	0.91	0.55				1.72	1.67	5.90
	27AUG	0.46	0.93				1.17	0.99	5.41
	24SEP	1.45	1.58				1.62	0.64	4.01
	22OCT	0.72	1.23				2.37	1.14	5.09
6	07MAY	0.72	0.42				0.99	1.30	3.36
	04JUN	0.94	0.39				1.10	1.99	3.94
	03JUL	1.84	0.51				5.64	4.22	5.23

Table 5. Variation in mean epilimnetic biological data for each station.

Year and Station	Date	Bacteria ($x10^6 \cdot mL^{-1}$)	Chlorophyll ($\mu g \cdot L^{-1}$) Total	Pico.	Nano.	Micro.	Phytoplankton (Numbers$\cdot mL^{-1}$) Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1985									
6	30JUL	0.51	0.57				3.95	2.69	4.37
	27AUG	0.76	1.10				2.73	2.86	9.02
	24SEP	0.81	1.35				2.85	1.52	7.77
	22OCT	0.49	0.55				0.69	0.64	2.87
7	08MAY	0.74	0.86				1.69	1.93	4.19
	05JUN	2.32	1.94				1.04	6.00	8.15
	04JUL	1.14	1.20				3.24	4.26	6.56
	31JUL	0.69	0.77				3.06	1.29	2.75
	28AUG	1.04	1.11				1.38	1.52	5.25
	25SEP	0.59	2.14				3.24	2.14	8.80
	23OCT	0.54	1.33				1.86	1.31	4.88
8	07MAY	0.68	0.63				1.10	1.35	5.13
	04JUN	1.25	1.55				1.50	4.46	7.92
	03JUL	1.15	0.53				3.75	3.29	6.70
	30JUL	0.82	0.64				4.15	1.61	4.74
	27AUG	0.63	0.96				1.69	1.00	4.64
	24SEP	1.08	1.56				1.79	0.74	3.56
	22OCT	1.16	1.29				2.51	0.78	4.92
9	07MAY	0.46	0.51				1.09	2.16	4.81
	04JUN	0.86	0.64				1.44	1.92	6.03
	03JUL	1.10	0.48				5.07	2.73	4.62
	30JUL	0.86	0.59				4.42	2.40	5.23
	27AUG	0.43	1.08				4.02	1.68	4.29
	24SEP	0.82	1.30				1.48	1.59	5.34
	22OCT	0.89	0.77				0.83	0.93	3.71
1986									
1	14MAY	0.72	0.67				2.25	2.24	6.66
	24JUN	0.32	1.82	1.33			3.33	4.19	9.32
	22JUL	0.33	1.27	0.75			3.23	3.39	23.37
	26AUG	0.37	0.76	0.35			2.53	2.07	8.34
	24SEP	0.51	0.93	0.47			3.73	1.42	10.00

Table 5. Variation in mean epilimnetic biological data for each station.

Year and Station	Date	Bacteria ($\times10^6\cdot mL^{-1}$)	Chlorophyll ($\mu g\cdot L^{-1}$) Total	Pico.	Nano.	Micro.	Phytoplankton ($Numbers\cdot mL^{-1}$) Pico. ($\times10^4$)	Nano. ($\times10^3$)	Micro. ($\times10^2$)
1986									
1	18OCT	0.85	1.49	0.81			4.44	2.30	11.03
4	15MAY	0.18	0.26				1.33	1.23	3.94
	25JUN	0.33	0.74	0.40			4.35	9.81	10.16
	23JUL	0.60	0.75	0.51			2.72	2.80	6.98
	27AUG	0.18	0.63	0.06			4.24	2.73	11.85
	24SEP		0.90	0.44			2.43	2.07	8.11
	17OCT	0.27	1.53	0.80			4.34	2.75	11.42
5	15MAY	0.28	0.40				2.01	1.27	4.11
	26JUN	0.47	1.14	0.69			2.92	3.80	10.63
	24JUL	0.26	0.85	0.39			2.77	3.26	12.08
	27AUG	0.19	1.00	0.38			2.76	2.10	13.43
	25SEP	0.25	1.21	0.75			3.25	2.14	14.93
	17OCT	0.27	1.29	0.71			4.45	2.90	8.24
6	15MAY	0.26	0.32				1.07	1.58	4.95
	25JUN	0.31	0.39	0.25			1.66	2.56	7.31
	23JUL	0.20	0.87	0.54			2.91	3.05	7.47
	27AUG	0.17	1.27	0.83			3.16	4.37	13.55
	24SEP	0.42	0.84	0.19			1.92	2.66	12.17
	16OCT	0.19	0.23	0.00			1.25	2.76	8.62
7	14MAY	0.65	0.50				1.56	2.05	4.84
	24JUN	0.36	1.30	0.90			3.01	3.60	15.88
	22JUL	0.39	1.05	0.63			3.97	1.83	10.53
	26AUG	0.36	0.76	0.61			3.56	1.74	8.16
	23SEP	0.44	1.21	0.67			3.39	1.63	8.48
	18OCT		1.32	0.63			4.08	2.01	11.83
8	16MAY	0.18	0.36				1.31	1.15	4.19
	26JUN	0.49	1.31	0.67			3.43	2.83	13.60
	24JUL	0.25	0.85	0.42			4.00	2.95	10.30
	28AUG	0.69	1.08	0.29			5.91	1.65	7.24
	25SEP	0.23	0.92	0.52			3.66	2.28	8.80

Table 5. Variation in mean epilimnetic biological data for each station.

Year and Station	Date	Bacteria ($x10^6 \cdot mL^{-1}$)	Chlorophyll ($\mu g \cdot L^{-1}$) Total	Pico.	Nano.	Micro.	Phytoplankton (Numbers·mL^{-1}) Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1986									
8	17OCT	0.32	1.28	0.69			4.95	2.25	10.76
9	15MAY	0.14	0.33				1.51	1.26	4.46
	25JUN	0.28	0.76	0.49			3.77	3.35	7.83
	23JUL	0.50	0.85	0.54			2.50	2.64	7.07
	27AUG	0.18	0.57	0.11			3.78	3.13	12.06
	24SEP	0.46	0.80	0.27			1.58	1.92	11.40
	16OCT	0.35	1.15	0.60			4.23	2.74	11.91
1987									
1	21MAY	0.40	0.52	0.24	0.10	0.18	2.79	2.12	8.03
	23JUN	0.70	1.69	0.96	0.47	0.27	2.33	5.91	10.29
	21JUL	0.31	0.96	0.62	0.16	0.18	2.76	3.19	5.16
	19AUG	0.61	1.02	0.63	0.21	0.18	3.58	1.94	4.78
	16SEP	0.40	1.14	0.68	0.39	<0.08	2.78	1.67	3.54
	21OCT	0.27	1.29	0.61	0.57	0.12	2.80	1.42	3.38
4	22MAY	0.71	0.64	0.34	0.12	0.18	2.76	3.16	8.80
	25JUN	0.28	1.06	0.67	0.22	0.18	2.23	4.52	9.46
	23JUL	0.34	0.75	0.46	0.10	0.18	2.76	3.59	6.93
	20AUG	0.30	0.91	0.61	0.12	0.18	1.93	2.48	5.23
	15SEP	0.47	0.78	0.42	0.27	0.09	3.29	2.24	4.76
	22OCT	0.34	1.41	0.85	0.50	<0.08	3.51	2.88	5.50
5	20MAY	0.44	0.95	0.43	0.34	0.18	2.38	2.88	11.38
	24JUN	0.38	1.31	0.72	0.42	0.18	1.84	5.38	14.30
	22JUL	0.36					2.02	3.22	8.15
	18AUG	0.36	1.38	0.77	0.52	0.09	2.91	2.79	8.57
	17SEP	0.40	1.21	0.76	0.38	<0.08	3.45	1.79	4.38
	22OCT	0.32	1.64	1.11	0.47	<0.08	3.63	2.16	4.55
6	22MAY	0.53	0.32	0.12	0.00	0.18	2.28	2.10	6.13
	25JUN	0.30	0.85	0.33	0.34	0.18	2.30	5.33	9.83
	23JUL	0.45	0.90	0.52	0.21	0.18	2.67	5.75	8.90
	20AUG	0.33	1.08	0.62	0.28	0.18	3.11	5.02	6.99
	15SEP	0.36	0.91	0.41	0.42	0.08	3.19	4.47	8.07

Table 5. Variation in mean epilimnetic biological data for each station.

Year and Station	Date	Bacteria ($x10^6 \cdot mL^{-1}$)	Chlorophyll ($\mu g \cdot L^{-1}$) Total	Pico.	Nano.	Micro.	Phytoplankton (Numbers$\cdot mL^{-1}$) Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1987									
6	22OCT	0.54	1.02	0.57	0.39	<0.08	3.15	3.61	5.48
7	21MAY	0.40	0.48	0.24	0.05	0.18	2.12	2.65	8.39
	23JUN	0.64	1.15	0.60	0.36	0.20	2.18	4.91	11.55
	21JUL	0.36	0.97	0.57	0.19	0.18	2.86	3.42	5.71
	19AUG	0.31	0.98	0.62	0.19	0.18	3.51	2.65	7.23
	16SEP	0.30	1.11	0.65	0.39	0.08	2.90	1.90	4.92
	21OCT	0.31	1.55	0.87	0.59	0.09	3.06	1.98	4.53
8	20MAY	0.45	0.54	0.28	0.04	0.18	3.22	2.70	6.26
	24JUN	0.32	1.19	0.64	0.37	0.18	2.53	5.28	7.72
	22JUL	0.40					2.74	2.93	4.24
	18AUG	0.30	1.10	0.63	0.40	<0.08	3.63	2.76	4.26
	17SEP	0.26	1.27	0.79	0.41	<0.08	2.98	2.15	2.75
	20OCT	0.35	1.23	0.76	0.40	<0.08	3.00	2.18	3.70
9	22MAY	0.54	0.63	0.31	0.14	0.18	2.71	4.20	9.11
	25JUN	0.34	1.21	0.70	0.33	0.18	2.17	6.33	11.70
	23JUL	0.47	0.86	0.55	0.14	0.18	2.83	4.22	6.69
	20AUG	0.28	0.97	0.61	0.18	0.18	3.22	3.02	6.28
	15SEP	0.37	0.71	0.41	0.23	<0.08	4.27	2.60	5.79
	22OCT	0.37	1.24	0.80	0.37	<0.08	3.46	2.67	4.20
1988									
1	10MAY	0.86	0.87	0.66			2.89	1.83	4.04
	07JUN	1.29	1.03	0.74	0.15	0.11	7.25	1.65	3.12
	12JUL	0.82	1.56	0.49	0.73	0.34	4.71	3.31	9.92
	16AUG	0.55	1.28	0.85	0.34	0.09	5.22	2.11	4.16
	14SEP	0.91	1.58	1.01	0.50	0.07	3.34	1.73	4.25
	11OCT	0.86	1.63	1.02	0.55	<0.08	2.59	1.28	2.61
	11MAY	0.82	0.50	0.25			2.47	1.49	2.97
	08JUN	0.73	1.22	0.88	0.28	<0.08	3.19	2.16	4.04
	13JUL	0.78	1.30	0.65	0.55	0.10	4.54	2.93	8.30
	17AUG	0.54	1.32	0.96	0.29	<0.08	4.17	1.70	4.09
	15SEP	1.20	1.17	0.58	0.51	<0.08	3.22	1.19	4.23

Table 5. Variation in mean epilimnetic biological data for each station.

Year and Station	Date	Bacteria ($x10^6 \cdot mL^{-1}$)	Chlorophyll ($\mu g \cdot L^{-1}$)				Phytoplankton ($Numbers \cdot mL^{-1}$)		
			Total	Pico.	Nano.	Micro.	Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1988									
3	12OCT	0.87	1.65	1.07	0.51	<0.08	2.93	1.27	3.08
4	09JUN	0.84	0.70	0.49	0.12	<0.08	4.18	0.97	2.45
	14JUL	0.54	0.21	0.00	0.43	0.10	5.97	1.65	7.57
	18AUG	0.68	1.57	0.91	0.59	<0.08	5.23	1.21	4.03
	16SEP	0.85	1.67	0.97	0.63	<0.08	3.12	1.23	3.60
	13OCT	0.69	1.51	0.94	0.51	<0.08	2.86	0.98	2.52
5	11MAY	0.72	0.64	0.37			2.90	1.30	2.64
	08JUN	0.78	1.35	0.90	0.38	<0.08	3.70	2.32	3.99
	13JUL	0.89	1.11	0.46	0.58	<0.08	4.83	2.15	8.28
	17AUG	0.53	1.07	0.74	0.25	<0.08	3.60	1.11	3.89
	15SEP	1.28	1.60	1.08	0.45	<0.08	3.42	0.97	3.30
	12OCT	0.93	1.73	1.13	0.54	<0.08	3.08	1.32	4.53
7	10MAY	1.02	1.33	1.10			1.99	2.36	6.08
	07JUN	0.87	1.02	0.66	0.25	0.11	3.76	1.27	2.10
	12JUL	0.92	1.25	0.71			4.23	1.88	7.46
	16AUG	0.68	1.25	0.78	0.39	0.08	4.62	1.04	2.69
	14SEP	1.01	1.78	1.18	0.53	<0.08	3.19	0.94	3.36
	11OCT	0.81	1.30	0.85	0.38	<0.08	2.92	1.17	2.10
9	12MAY	0.69	0.36	0.29			1.51	0.77	1.80
	09JUN	0.69	0.88	0.61	0.20	<0.08	4.29	1.17	2.07
	14JUL	0.61	0.47	0.05	0.35	0.07	5.22	1.60	5.61
	18AUG	0.75	1.04	0.64	0.33	<0.08	4.99	1.81	2.81
	16SEP	0.68	1.59	0.84	0.64	0.12	2.62	1.13	2.26
	13OCT	1.05	1.75	1.15	0.49	0.12	3.39	1.26	3.48
1990									
1	17MAY	0.68	1.19	0.81	0.26	0.12	2.58	0.57	1.73
	20JUN	0.80	0.37	0.09	0.20	0.08	2.78	0.44	1.65
	20JUL	0.82	1.63	0.57	0.46	0.61	7.89	1.02	8.25
	24AUG	0.44	2.02	1.13	0.56	0.33	6.47	0.68	8.13
	20SEP	0.71	1.24	0.73	0.44	<0.08	5.53	0.58	5.07
	26OCT	1.06	1.62	1.00	0.51	0.11	3.97	0.58	4.67

Table 5. Variation in mean epilimnetic biological data for each station.

Year and Station	Date	Bacteria ($x10^6 \cdot mL^{-1}$)	Chlorophyll ($\mu g \cdot L^{-1}$) Total	Pico.	Nano.	Micro.	Phytoplankton ($Numbers \cdot mL^{-1}$) Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1990									
3	18MAY	0.71	0.67	0.42	0.18	<0.08	2.79	0.39	1.50
	21JUN	0.57	0.65	0.43	0.15	<0.08	4.75	0.83	1.89
	19JUL	0.72	0.76	0.42	0.00	0.56	3.79	0.70	6.01
	23AUG	0.39	1.40	0.81	0.00	0.60	3.09	0.69	6.07
	19SEP	0.68	1.20	0.92	0.22	<0.08	2.25	0.67	4.72
	25OCT	0.82	1.03	0.71	0.23	0.08	4.43	0.41	2.84
4	18MAY	0.73	0.33	0.26	0.00	0.07	2.16	0.38	0.96
	22JUN	0.83	0.72	0.46	0.19	0.08	3.70	0.93	1.35
	18JUL	0.76	0.93	0.41	0.04	0.46	6.94	0.61	5.98
	22AUG	0.37	1.64	0.86	0.64	0.13	4.00	1.08	4.49
	21SEP	0.80	0.97	0.49	0.42	<0.08	2.40	0.80	4.42
	24OCT	0.69	0.99	0.51	0.40	0.08	2.86	0.40	2.53
5	18MAY	0.63	1.14	0.67	0.35	0.11	2.12	0.91	2.92
	21JUN	0.64	0.86	0.47	0.31	<0.08	1.89	0.90	3.66
	19JUL	0.76	0.85	0.41	0.00	0.66	3.49	0.98	5.96
	23AUG	0.44	1.32	0.64	0.61	0.08	1.65	0.51	5.08
	19SEP	0.79	1.18	0.81	0.30	<0.08	3.88	0.39	2.69
	25OCT	0.82	1.48	0.91	0.48	0.09	5.53	0.38	3.68
7	17MAY	1.28	1.15	0.81	0.22	0.12	1.26	0.87	1.43
	20JUN	0.99	0.52	0.21			4.65	0.58	1.08
	20JUL	0.80	1.60	0.51	0.50	0.59	6.86	1.20	6.73
	24AUG	0.49	1.44	0.81	0.43	0.21	3.50	0.69	4.70
	20SEP	0.76	1.36	0.79	0.50	<0.08	3.78	0.65	4.75
	26OCT	1.12	1.28	0.71	0.48	0.09	4.26	0.48	3.87
8	16MAY	0.71	0.32	0.18	0.05	0.12	1.64	0.23	1.30
	19JUN	1.17	0.65	0.35	0.23	<0.08	4.66	1.70	3.30
	17JUL	0.77	1.25	0.55	0.00	0.66	7.30	0.63	9.94
	21AUG	0.48	1.53	0.88	0.56	0.10	5.97	0.71	5.01
	18SEP	0.65	1.38	0.85	0.46	<0.08	5.32	0.63	4.12
	23OCT	0.67	0.88	0.49	0.30	0.09	5.05	0.77	4.09
9	17MAY	0.55	0.25	0.18	0.00	<0.08	0.97	0.15	0.77

Table 5. Variation in mean epilimnetic biological data for each station.

Year and Station	Date	Bacteria ($x10^6 \cdot mL^{-1}$)	Chlorophyll ($\mu g \cdot L^{-1}$)				Phytoplankton (Numbers$\cdot mL^{-1}$)		
			Total	Pico.	Nano.	Micro.	Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1990									
9	22JUN	0.95	0.66	0.47	0.13	<0.08	5.32	0.50	1.52
	18JUL	0.73	0.71	0.21	0.15	0.37	5.20	0.54	3.14
	22AUG	0.50	1.34	0.66	0.08	0.60	3.48	0.51	2.48
	21SEP	0.68	1.16	0.71	0.38	<0.08	3.15	0.54	3.73
	24OCT	0.76	0.60	0.23	0.30	<0.08	1.60	0.21	1.49

Table 6. Variation in pH, total alkalinity and photosynthetic rate data for each station.

Year and Station	Date	pH	T. Alk. ($mg \cdot L^{-1}$)	Photosynthetic rate ($mg\ C \cdot m^{-2} \cdot d^{-1}$)			
				Total	Pico.	Nano.	Micro.
1986							
7	14MAY	6.8	48.33	82.9	28.6		
	24JUN	7.1	41.35	251.8	117.5		
	22JUL	7.5	42.69	141.9	42.1		
	26AUG	7.8	43.74	115.4	77.2		
	23SEP	7.5	43.74	75.9	39.1		
	18OCT	7.4	45.33	100.3	39.4		
8	16MAY	6.8	48.12	67.1	19.9		
	26JUN	7.4	43.16	241.5	132.5		
	24JUL	7.3	44.93	114.2	61.0		
	28AUG	7.6	44.60	42.7	23.8		
	25SEP	7.4	45.41	138.3	34.0		
	17OCT	7.5	42.89	66.0	25.6		
1987							
7	21MAY	7.6	46.50	42.0	15.5	15.3	11.2
	23JUN	7.6	42.04	118.7	51.3	51.4	16.0
	21JUL	7.3	46.82	91.7	24.9	28.3	61.2
	19AUG	8.0	47.24	85.3	16.5	24.3	47.4
	16SEP	8.0	48.03	106.0	30.2		
	21OCT	7.6	48.37	102.3	33.9	33.4	37.2
8	20MAY	7.7	48.94	50.3	26.3	4.2	27.4
	24JUN	7.4	47.36	153.0	55.8	83.4	13.8
	22JUL	7.4	47.75	136.2	64.6	31.5	40.2
	18AUG	8.0	48.21	124.1	50.1	72.4	1.5
	17SEP	8.0	48.55	107.7	49.2	5.4	53.2
	20OCT	7.5	48.53	72.2	35.8	17.7	23.3
1988							
3	11MAY	7.5	45.69	116.9	35.6		
	08JUN	7.7	45.16	29.0	9.2	30.9	0.0
	13JUL	7.7	41.08	81.8			
	17AUG	7.0	46.67	102.2	48.3	38.6	15.3
	15SEP	6.6	47.52	50.8	11.2	24.7	19.9
	12OCT	6.4	47.22	185.9	80.2	67.1	63.2

Table 6. Variation in pH, total alkalinity and photosynthetic rate data for each station.

Year and Station	Date	pH	T. Alk. ($mg \cdot L^{-1}$)	Photosynthetic rate ($mg\ C \cdot m^{-2} \cdot d^{-1}$) Total	Pico.	Nano.	Micro.
1988							
7	10MAY	7.4	39.63	34.7	2.2		
	07JUN	7.6	41.71	44.5	22.2	15.9	6.4
	12JUL	7.6	41.84	193.8	52.1	101.9	43.7
	16AUG	6.9	44.82				
	14SEP	6.7	46.09	80.3	36.6	22.1	38.8
	11OCT	6.4	46.64	88.0	21.0	43.4	52.4
9	12MAY	7.6	44.02	65.7	6.7		
	09JUN	7.6	46.51	47.1	12.6	4.7	84.2
	14JUL	7.7	44.48	149.9			
	18AUG	6.8	47.20	172.3	92.3	55.8	30.0
	16SEP	6.5	47.38	139.7	48.1	46.5	72.1
	13OCT	6.7	47.27				
1990							
3	18MAY	7.7	45.17	45.5	28.2	14.0	3.3
	21JUN	7.6	42.00	38.3	15.3	9.2	13.8
	19JUL	7.8	56.63	131.7	47.4	53.7	30.6
	23AUG	7.9	59.53	160.8	68.9	67.9	24.0
	19SEP	7.9	44.03	199.9	90.7	81.5	27.7
	25OCT	7.8	44.63	31.3	12.5	10.3	17.3
7	17MAY	7.7	41.30	61.5	26.3	22.0	13.2
	20JUN	7.5	41.77	35.9	18.2	11.9	5.9
	20JUL	8.0	55.67	134.5	40.8	39.3	54.5
	24AUG	8.0	58.87	103.7	27.3	55.0	21.4
	20SEP	7.9	43.73	91.2	42.9	39.1	9.3
	26OCT	7.9	44.93	81.9	19.5	39.8	27.8
8	16MAY	7.6	45.53	19.5	6.3	5.3	9.3
	19JUN	7.4	42.83	25.4	7.4	7.0	8.7
	17JUL	7.9	54.60	147.6	24.9	38.3	97.6
	21AUG	8.0	59.43	178.2	57.8	66.3	54.2
	18SEP	7.8	44.90	309.7	167.1	78.2	64.4
	23OCT	7.8	44.47	73.2	26.3	32.2	14.7

Table 6. Variation in pH, total alkalinity and photosynthetic rate data for each station.

Year and Station	Date	pH	T. Alk. ($mg \cdot L^{-1}$)	Photosynthetic rate ($mg\ C \cdot m^{-2} \cdot d^{-1}$) Total	Pico.	Nano.	Micro.
1990							
9	22JUN	7.8	43.67	31.7	11.4	7.5	13.0
	18JUL	7.9	57.73	143.0	41.6	62.7	64.2
	22AUG	8.0	58.17	126.8	42.5	60.0	24.3

Table 7. Variation in discrete biological and chemical data from station 8 in 1990.

Date and Depth (m)	Nitrate (µg N·L^{-1})	Total P (µg P·L^{-1})	Part. P (µg P·L^{-1})	Bacteria (x10^{6}·mL^{-1})	Total Chlorophyll (µg·L^{-1})	Phytoplankton (Numbers· mL^{-1}) Pico. (x10^{4})	Nano. (x10^{3})	Micro. (x10^{2})
19JUN								
0		1		0.91	0.57	3.96	1.21	1.67
4		10	8.4	0.66	0.89	4.35	0.95	1.99
8			6.1	0.71	0.63	3.44	0.84	1.54
12	96	2	2.0	0.71	0.69	3.88	0.35	1.07
16	98	2	1.7	0.75	0.54	4.66	0.89	4.16
20	101	2	1.3	0.65	0.37	2.19	0.28	1.51
24	98	2	1.1	0.83	0.43	0.64	0.17	0.72
28		2	1.0	0.63	0.37	2.30	0.26	1.03
32	97	2	1.3	0.39	0.45	1.97	0.26	0.94
50	98	6	1.4	0.56	0.37	1.22	0.29	0.98
17JUL								
0	49	5	3.1	0.73	1.39	6.96	0.35	5.62
4	51	7	1.9	0.80	1.88	8.90	0.42	7.83
8	66	4	1.2	0.73	1.33	6.21	0.47	7.89
12	88	3	2.0	0.65	1.04	9.81	0.32	1.68
16	95	4	1.2	0.64	0.94	4.21	0.30	2.45
20	96	3	1.3	0.69	0.67	1.66	0.26	1.65
24	97	3	1.0	0.60	0.52	1.14	0.17	1.17
28	100	3	0.8	0.55	0.45	0.86	0.23	0.88
32	101	3	0.8	0.50	0.37	0.58	0.23	0.81
50	62	6	0.7	0.52	0.26	0.83	0.15	0.97
21AUG								
0	59	3	1.0	0.38	1.11	3.47	0.40	5.45
4	60	3	0.9	0.39	1.06	2.42	0.58	5.35
8	64	3	1.5	0.52	1.24	4.26	1.02	7.00
12	86	4	1.7	0.53	1.87	6.39	0.75	5.22
16	116	3	1.7	0.45	1.73	14.39	0.56	8.91
20	139	3	1.6	0.57	1.15	13.57	0.43	7.75
24	86	3	1.6	0.40	0.97	9.82	0.36	5.07
28	88	3	1.4	0.33	0.57	1.85	0.22	2.05

Table 7. Variation in discrete biological and chemical data from station 8 in 1990.

Date and Depth (m)	Nitrate (µg N·L^{-1})	Total P (µg P·L^{-1})	Part. P (µg P·L^{-1})	Bacteria (x10^{6}·mL^{-1})	Total Chlorophyll (µg·L^{-1})	Phytoplankton (Numbers· mL^{-1}) Pico. (x10^{4})	Nano. (x10^{3})	Micro. (x10^{2})
21AUG								
32	67	3	1.4	0.30	0.30	1.37	0.28	1.79
50	134	2	1.2	0.30	0.26	0.59	0.17	0.63
18SEP								
0	55	5	0.7	0.55	1.59	1.86	0.98	4.21
4	55	4	0.8	0.58	1.48	2.11	0.78	5.38
8	53	8	1.5	0.60	1.48	2.05	0.49	3.27
12	95		0.9	0.59	1.44	6.48	0.42	5.67
16	116	7	1.1	0.75	1.15	8.40	0.39	3.63
20	127	5	1.2	0.81	1.18	10.92	0.28	2.65
24	134	4	1.2	0.50	1.00	1.64	0.36	5.96
28	135	4	1.2	0.47	1.04	0.86	0.20	2.29
32	137	3	1.0	0.47	0.41	0.42	0.28	1.30
50	134	6	1.1	0.56	0.37	0.14	0.14	0.58
23OCT								
0	79	4	1.4	0.53		3.41	0.64	3.41
4	83	4	1.3	0.66		4.71	0.89	4.52
8	89	4	<0.5	0.73		4.46	0.69	4.60
12	92	4	1.2	0.65		3.63	0.52	2.84
16	96	3	1.3	0.65		0.17	0.41	2.89
20	94	3	1.5	0.57		5.01	0.37	1.84
24	95	3	1.4	0.63		4.49	0.48	3.04
28	103	3	1.2	0.47		3.27	0.39	2.60
32	117	4	1.2	0.50		2.30	0.37	2.34
50	133	3	0.9	0.49	0.11	0.22	0.18	0.56

Table 8. Seasonal (May-October) averages of physical data for each station.

Year and Station	Surface temp. (°C)	Mean epil. temp. (°C)	Thermocline depth (m)	Euphotic zone depth (m)	Ext. coeff. ($\cdot m^{-1}$)	Secchi depth (m)
1985						
1	11.7	12.5	8.1	13.0	0.34	8.8
2	13.0	12.4	10.3	14.0	0.33	9.9
4	12.8	11.7	15.8	15.0	0.29	11.1
5	13.3	12.5	8.2	13.2	0.34	8.8
6	11.7	11.4	12.5	11.5	0.43	7.1
7	13.4	13.0	9.6	12.2	0.40	8.4
8	13.3	12.6	11.7	14.3	0.31	11.4
9	12.2	11.7	14.9	15.0	0.30	10.2
1986						
1	13.9	12.1	18.1	15.4	0.28	9.7
4	13.3	12.0	12.6	16.4	0.27	11.3
5	12.9	11.9	14.5	15.7	0.28	11.2
6	11.6	10.6	9.1	14.5	0.31	8.0
7	13.9	12.0	16.0	13.9	0.33	9.0
8	12.9	11.4	14.4	14.8	0.31	10.3
9	12.4	11.2	14.4	16.9	0.26	10.5
1987						
1	13.6	12.9	13.9	17.3	0.25	11.4
4	14.7	13.4	17.9	16.9	0.26	10.7
5	13.9	11.3	10.9	16.7	0.25	11.2
6	12.6	12.4	13.5	13.4	0.33	6.0
7	13.8	13.3	14.3	13.9	0.30	9.3
8	13.6	12.9	13.4	15.3	0.27	10.5
9	14.9	13.0	13.5	16.7	0.26	9.1
1988						
1	13.7	12.6	10.5	15.3	0.29	10.3
3	12.9	12.7	11.9	17.6	0.24	11.0
4	13.7	13.1	11.3	16.5	0.26	10.0
5	13.6	13.2	12.3	16.3	0.26	10.0
7	13.7	12.3	7.4	14.3	0.33	8.9
9	12.1	11.6	9.7	16.7	0.25	8.9

Table 8. Seasonal (May-October) averages of physical data for each station.

Year and Station	Surface temp. (°C)	Mean epil. temp. (°C)	Thermocline depth (m)	Euphotic zone depth (m)	Ext. coeff. ($\cdot m^{-1}$)	Secchi depth (m)
1990						
1	12.3	11.1	7.0	13.9	0.32	9.5
3	14.1	13.7	8.1	14.5	0.31	9.6
4	14.3	13.7	7.8	14.4	0.32	9.2
5	15.0	14.1	11.1	14.0	0.32	7.8
7	13.4	12.7	8.9	9.3	0.54	6.6
8	14.5	13.3	9.8	12.6	0.45	8.6
8.1	15.0	13.7	8.3	15.2	0.29	7.4
9	13.4	13.1	11.9	15.1	0.31	9.2

Table 9. Seasonal (May-October) averages of chemical data for each station.

Year and Station	Nitrate ($\mu g\ N \cdot L^{-1}$)	Total P ($\mu g\ P \cdot L^{-1}$)	Part. P ($\mu g\ P \cdot L^{-1}$)	Silica ($mg\ Si \cdot L^{-1}$)	T.D.S. ($mg \cdot L^{-1}$)
1985					
1	69.8	2.7	1.2	1.44	63
2	72.4	2.6	1.8	1.38	63
4	78.5	1.7	1.4	1.38	64
5	73.0	2.2	1.2	1.13	63
6	87.6	2.5	1.7	1.34	74
7	61.9	2.6	1.8	1.47	58
8	73.2	2.3	1.1	1.31	73
9	83.1	1.9	1.2	1.34	65
1986					
1	65.5	2.7	1.6		54
4	73.3	2.1	1.2		62
5	67.8	2.0	1.0		54
6	78.1	2.1	1.4		63
7	68.6	2.7	1.8		62
8	78.3	2.7	1.5		55
9	74.6	2.1	1.1		61
1987					
1	63.9	3.0	2.1	1.77	62
4	67.3	2.6	2.2	1.65	71
5	57.6	2.5	2.2	1.61	62
6	77.6	3.1	2.0	1.59	68
7	61.0	2.8	2.0	1.72	66
8	71.0	2.7	2.1	1.69	65
9	75.3	2.4	2.2	1.56	66
1988					
1	49.3	3.0	2.1	1.95	58
3	52.5	2.4	1.4	1.79	66
4	48.3	2.2	1.7	1.88	64
5	55.1	2.1	1.8	1.73	71
7	47.6	3.3	2.4	2.11	66
9	56.8	2.3	2.1	1.87	65

Table 9. Seasonal (May-October) averages of chemical data for each station.

Year and Station	Nitrate (µg N·L^{-1})	Total P (µg P·L^{-1})	Part. P (µg P·L^{-1})	Silica (mg Si·L^{-1})	T.D.S. (mg·L^{-1})
1990					
1	89.0	3.7	1.9	1.66	62
3	83.1	3.1	1.6	1.61	57
4	81.4	3.3	2.1	1.64	61
5	75.5	3.0	1.7	1.65	70
7	74.7	4.1	2.4	1.89	70
8	78.3	4.2	2.1	1.51	62
9	90.6	3.2	2.9	1.66	65

Table 10. Seasonal (May-October) averages of biological data for each station.

Year and Station	Bacteria ($x10^6 \cdot mL^{-1}$)	Chlorophyll ($\mu g \cdot L^{-1}$) Total	Pico.	Nano.	Micro.	Phytoplankton (Numbers·mL^{-1}) Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1985								
1	0.84	1.30				2.08	2.63	5.98
2	0.75	1.16				2.54	2.15	6.72
4	0.64	0.88				2.87	1.70	4.71
5	0.87	1.10				1.89	2.14	7.11
6	0.91	0.74				2.84	2.37	5.57
7	1.07	1.38				2.28	2.82	6.02
8	0.97	1.04				2.44	2.04	5.44
9	0.79	0.79				2.89	1.97	4.96
1986								
1	0.46	1.17	0.65			3.16	2.73	11.83
4	0.31	0.74	0.39			3.28	4.02	8.79
5	0.30	0.98	0.54			2.90	2.67	11.14
6	0.26	0.72	0.46			2.16	2.93	9.19
7	0.42	1.02	0.67			3.27	2.21	10.24
8	0.38	0.98	0.46			3.92	2.26	9.39
9	0.32	0.72	0.36			2.89	2.61	8.96
1987								
1	0.46	1.14	0.66	0.32	0.17	2.84	2.87	5.88
4	0.39	0.92	0.55	0.21	0.15	2.71	3.17	6.73
5	0.38	1.30	0.75	0.43	0.12	2.67	3.12	8.64
6	0.40	0.87	0.43	0.29	0.15	2.79	4.61	7.86
7	0.39	1.05	0.60	0.29	0.15	2.80	3.01	7.15
8	0.34	1.11	0.64	0.35	0.11	3.00	3.11	4.82
9	0.38	0.94	0.57	0.23	0.14	3.12	3.91	7.42
1988								
1	0.88	1.34	0.77	0.48	0.16	4.74	2.12	5.13
3	0.81	1.22	0.75	0.43	0.08	3.62	1.92	4.87
4	0.70	1.09	0.61	0.48	0.08	4.57	1.28	4.54
5	0.85	1.25	0.77	0.44	<0.08	3.76	1.61	4.74
7	0.87	1.31	0.85	0.38	0.09	3.71	1.39	4.03
9	0.71	0.98	0.55	0.40	0.09	4.01	1.37	3.16

Table 10. Seasonal (May-October) averages of biological data for each station.

Year and Station	Bacteria ($x10^6 \cdot mL^{-1}$)	Chlorophyll ($\mu g \cdot L^{-1}$) Total	Pico.	Nano.	Micro.	Phytoplankton (Numbers$\cdot mL^{-1}$) Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1990								
1	0.73	1.33	0.69	0.41	0.24	5.16	0.66	5.22
3	0.63	0.97	0.63	0.12	0.27	3.50	0.65	4.13
4	0.69	0.98	0.52	0.30	0.16	3.87	0.76	3.57
5	0.67	1.11	0.63	0.33	0.19	2.98	0.68	4.12
7	0.86	1.22	0.62	0.43	0.27	4.30	0.76	3.96
8	0.75	1.07	0.59	0.28	0.20	5.29	0.83	4.98
9	0.70	0.85	0.45	0.17	0.23	3.62	0.45	2.37

Table 11. Seasonal (May-October) averages of pH, total alkalinity and photosynthetic rate data for each station.

Year and Station	pH	T. Alk. ($mg \cdot L^{-1}$)	Photosynthetic rate ($mg\ C \cdot m^{-2} \cdot d^{-1}$)			
			Total	Pico.	Nano.	Micro.
1986						
7	7.4	43.65	133.6	56.7		
8	7.4	44.83	111.9	51.9		
1987						
7	7.7	46.34	84.3	26.6	28.0	33.1
8	7.7	48.14	100.8	43.8	34.0	24.7
1988						
3	7.2	45.20	81.8	31	31.8	15.1
7	7.2	43.42	94.9	29.9	41.8	29.5
9	7.2	46.19	102.1	38.8	25.9	47.8
1990						
3	7.8	49.31	100.7	43.4	39.5	18.9
7	7.8	48.51	81.0	28.2	32.6	20.8
8	7.8	49.29	124.9	48.2	37.1	41.7
9	7.9	51.46	81.3	30.1	33.6	22.5

Table 12. Annual whole-lake averages of physical data.

Year	Surface temp. (°C)	Mean epil. temp. (°C)	Thermocline depth (m)	Euphotic zone depth (m)	Ext. coeff. ($\cdot m^{-1}$)	Secchi depth (m)
1985	12.7	12.2	11.4	13.5	0.34	9.4
1986	12.9	11.6	13.8	15.4	0.29	10.2
1987	13.9	12.7	13.9	15.8	0.27	9.8
1988	13.2	12.5	10.5	16.3	0.27	9.7
1990	13.9	13.2	9.7	13.7	0.36	8.8

Table 13. Annual whole-lake averages of chemical data.

Year	Nitrate ($\mu g\ N \cdot L^{-1}$)	Total P ($\mu g\ P \cdot L^{-1}$)	Part. P ($\mu g\ P \cdot L^{-1}$)	Silica ($mg\ Si \cdot L^{-1}$)	T.D.S. ($mg \cdot L^{-1}$)
1985	75.7	2.3	1.4	1.33	66
1986	73.0	2.3	1.3		59
1987	67.9	2.7	2.1	1.65	66
1988	51.7	2.	1.9	1.89	65
1990	83.0	3.5	2.3	1.65	64

Table 14. Annual whole-lake averages of biological data.

		Chlorophyll ($\mu g \cdot L^{-1}$)				Phytoplankton (Numbers$\cdot mL^{-1}$)		
Year	Bacteria ($x10^6 \cdot mL^{-1}$)	Total	Pico.	Nano.	Micro.	Pico. ($x10^4$)	Nano. ($x10^3$)	Micro. ($x10^2$)
1985	0.85	1.02				2.48	2.19	5.86
1986	0.34	0.88	0.48			3.10	2.82	9.79
1987	0.38	1.05	0.60	0.31	0.14	2.84	3.42	6.96
1988	0.76	1.12	0.66	0.44	0.09	4.18	1.47	4.20
1990	0.72	1.02	0.55	0.27	0.22	4.09	0.66	3.76

Table 15. Annual whole-lake averages of pH, total alkalinity and photosynthetic rate data.

			Photosynthetic rate ($mg\ C \cdot m^{-2} \cdot d^{-1}$)			
Year	pH	T. Alk. ($mg \cdot L^{-1}$)	Total	Pico.	Nano.	Micro.
1985						
1986	7.36	44.24	122.8	54.3		
1987	7.70	47.24	92.6	35.2	31.0	28.9
1988	7.19	44.90	92.9	33.2	33.2	30.8
1990	7.83	49.64	97.0	37.5	35.7	26.0

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Fig 1. Location of Quesnel Lake.

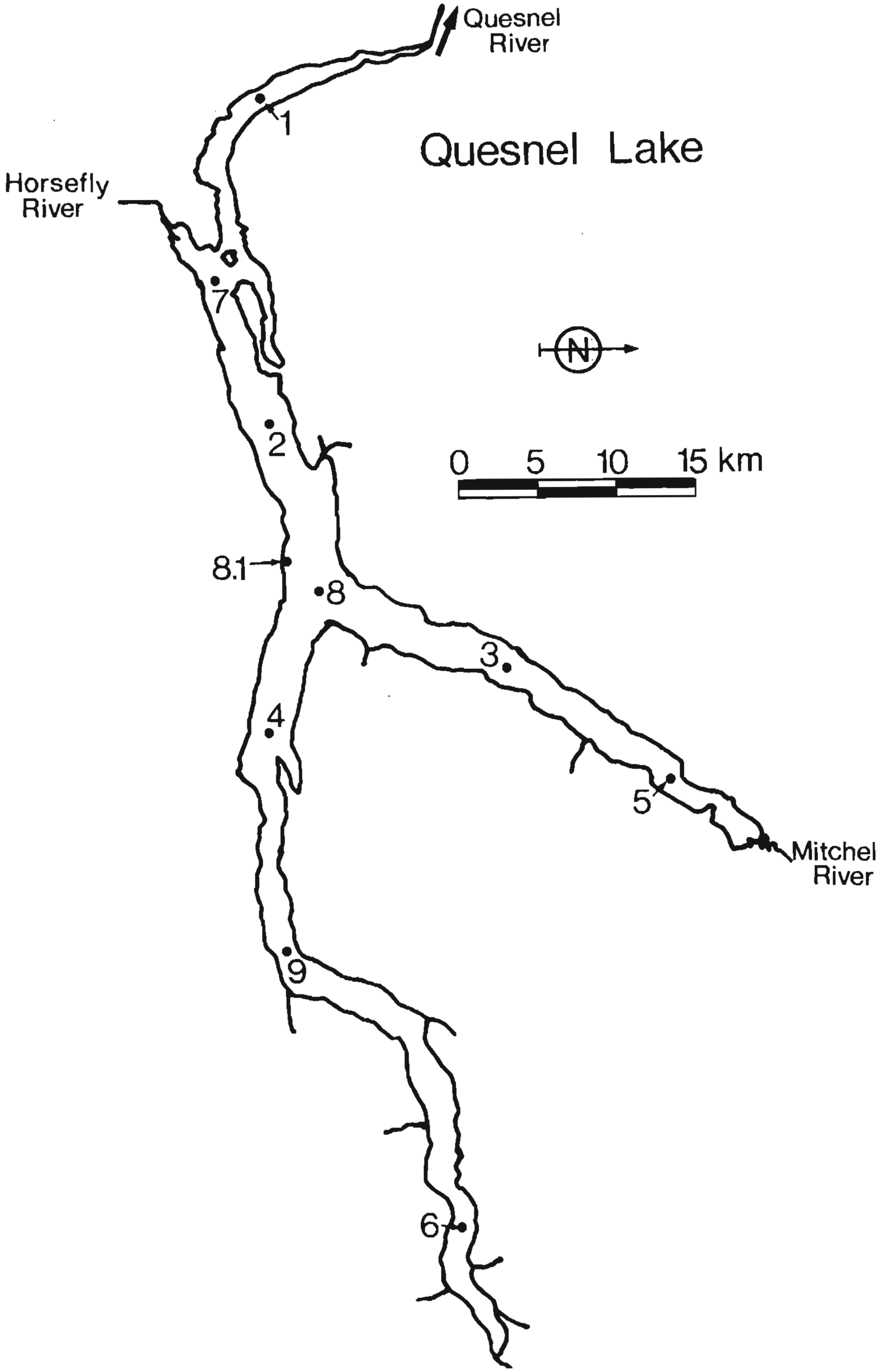
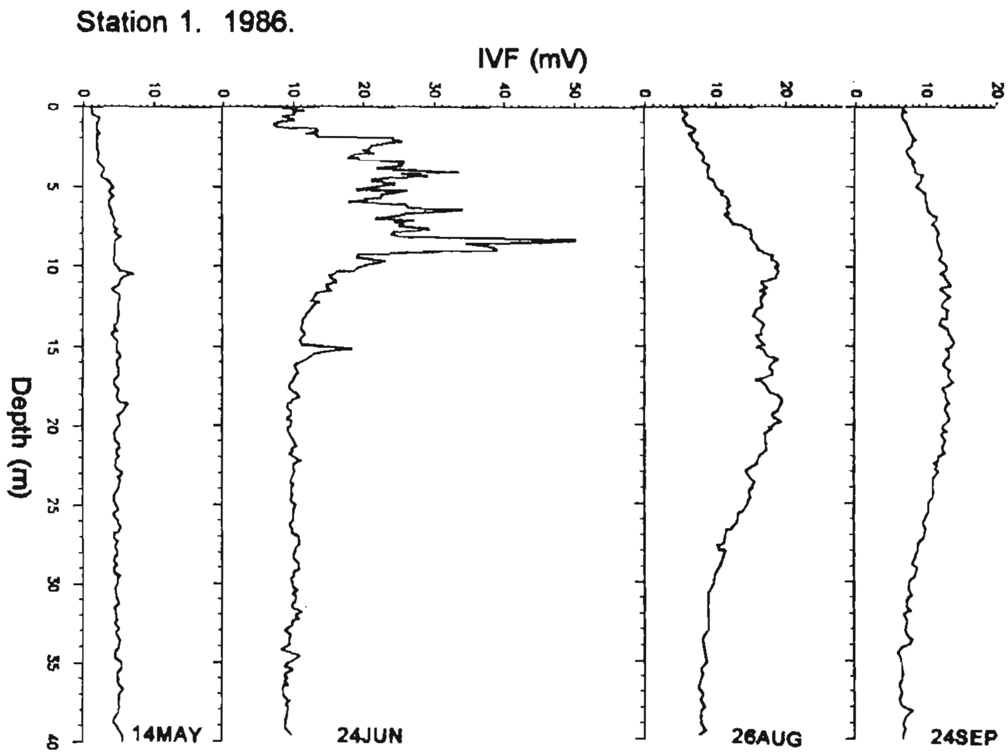


Fig 2. Location of sampling stations.



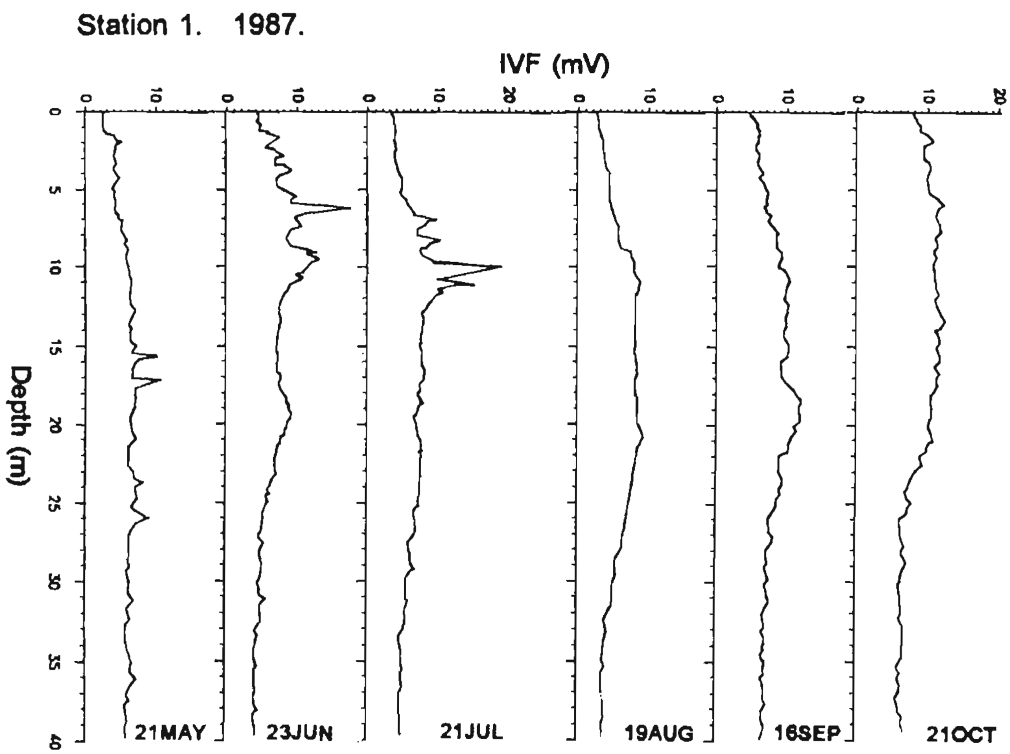
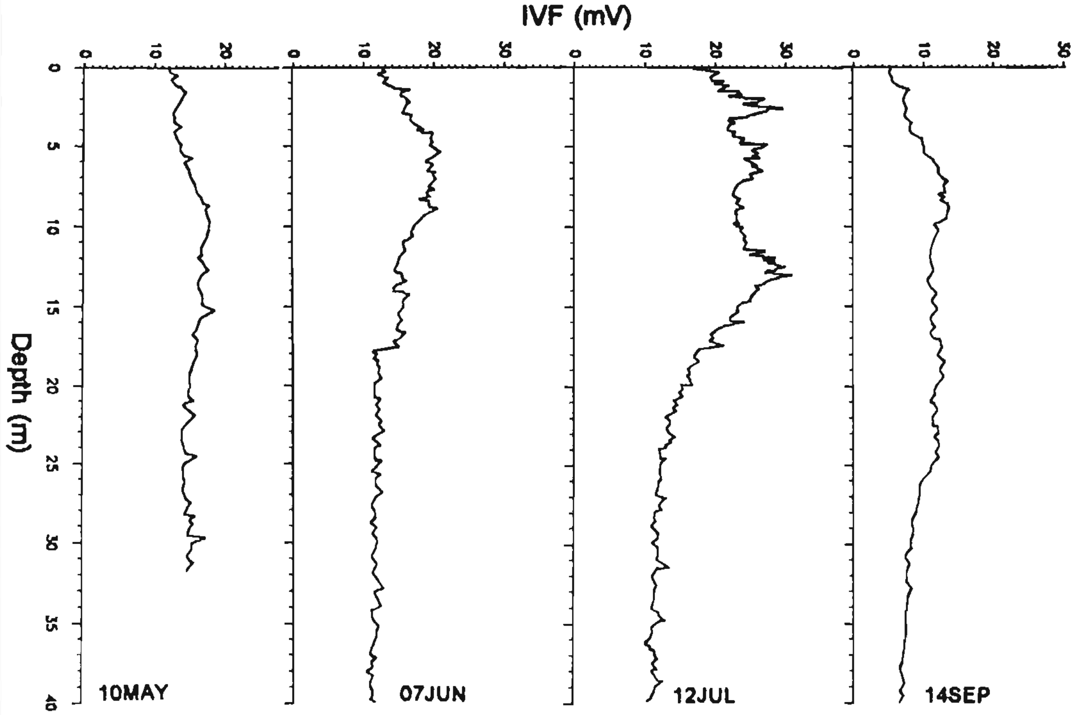


Fig 3. Variation of *in vivo* fluorescence with depth.

Station 1. 1988.



Station 1. 1990.

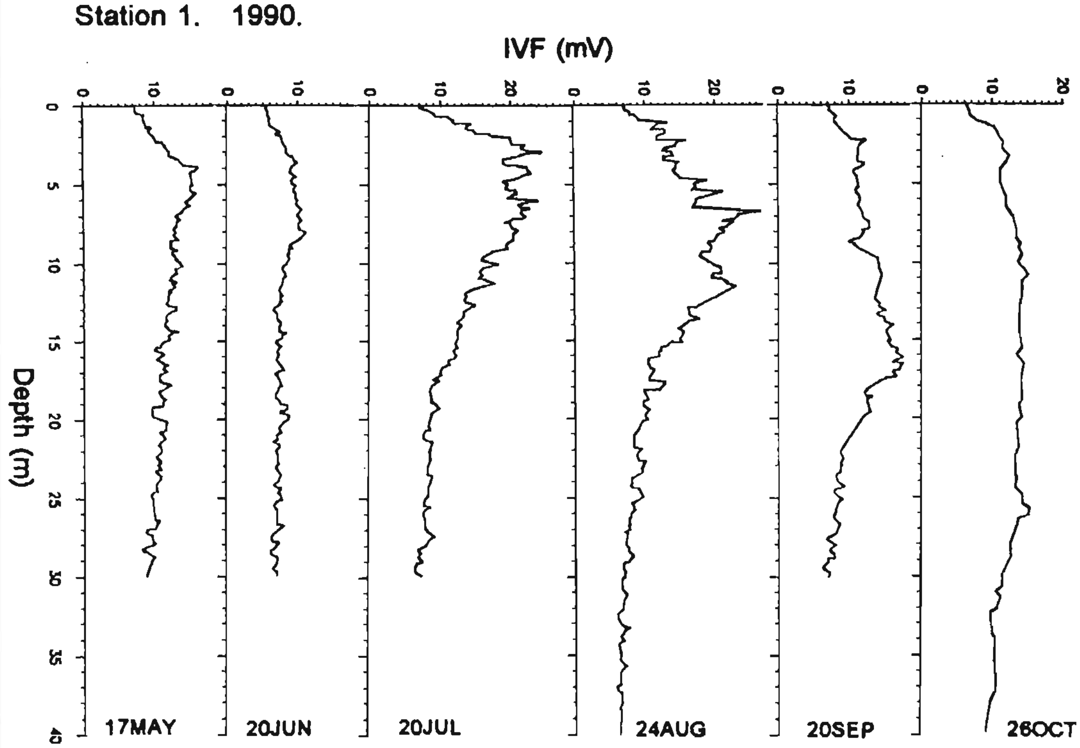
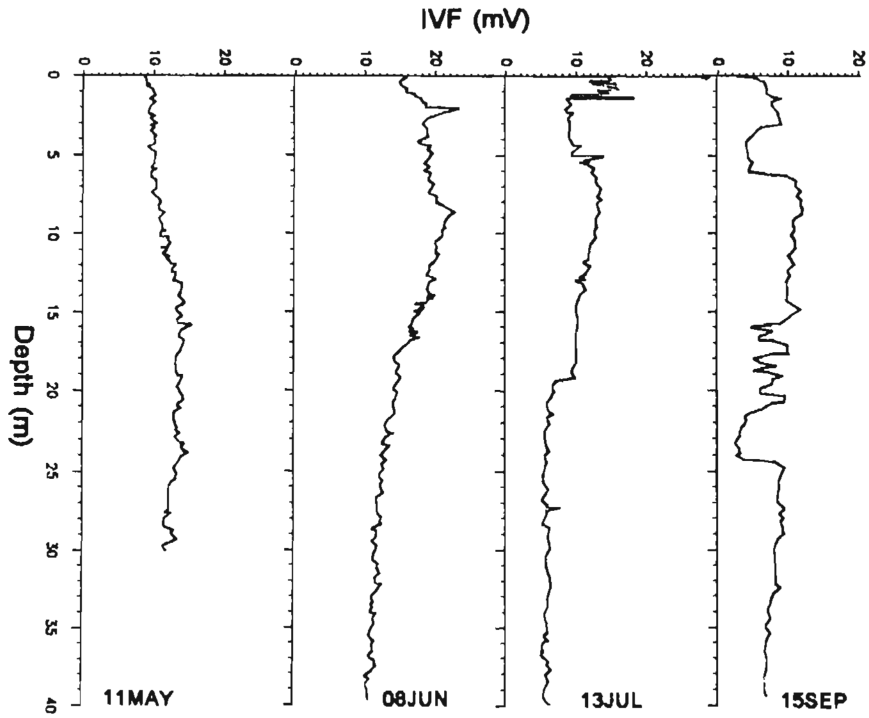


Fig 3. Variation of *in vivo* fluorescence with depth.

Station 3. 1988.



Station 3. 1990.

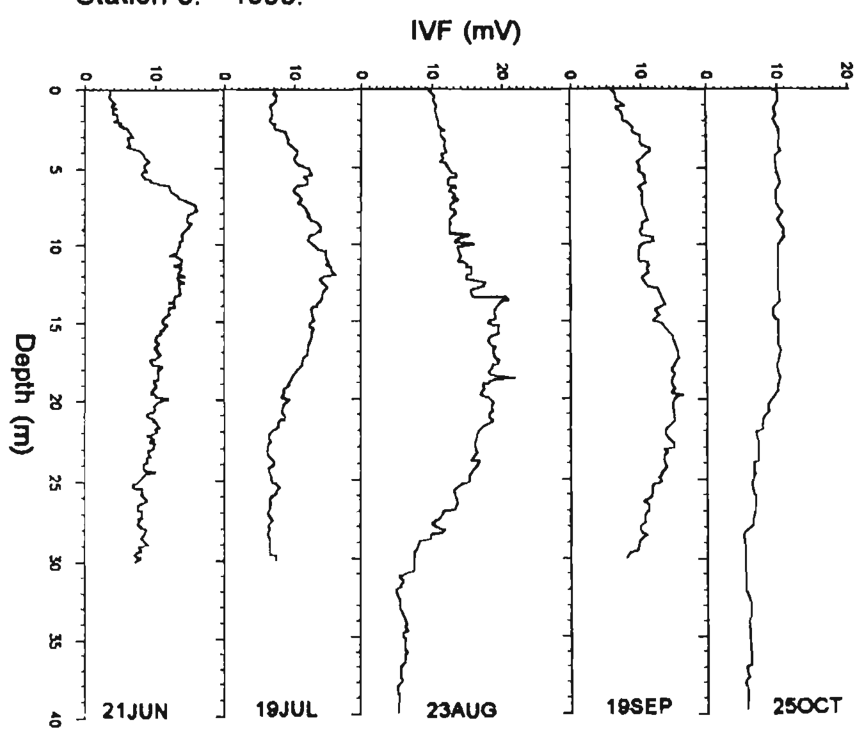
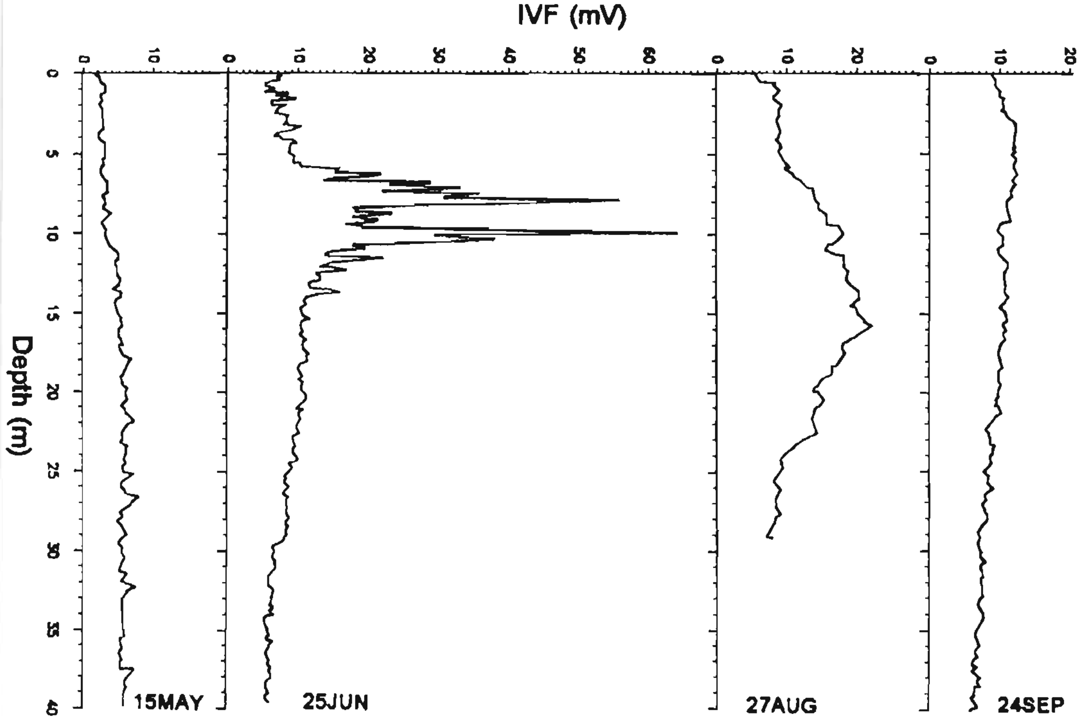


Fig 3. Variation of *in vivo* fluorescence with depth.

Station 4. 1986.



Station 4. 1987.

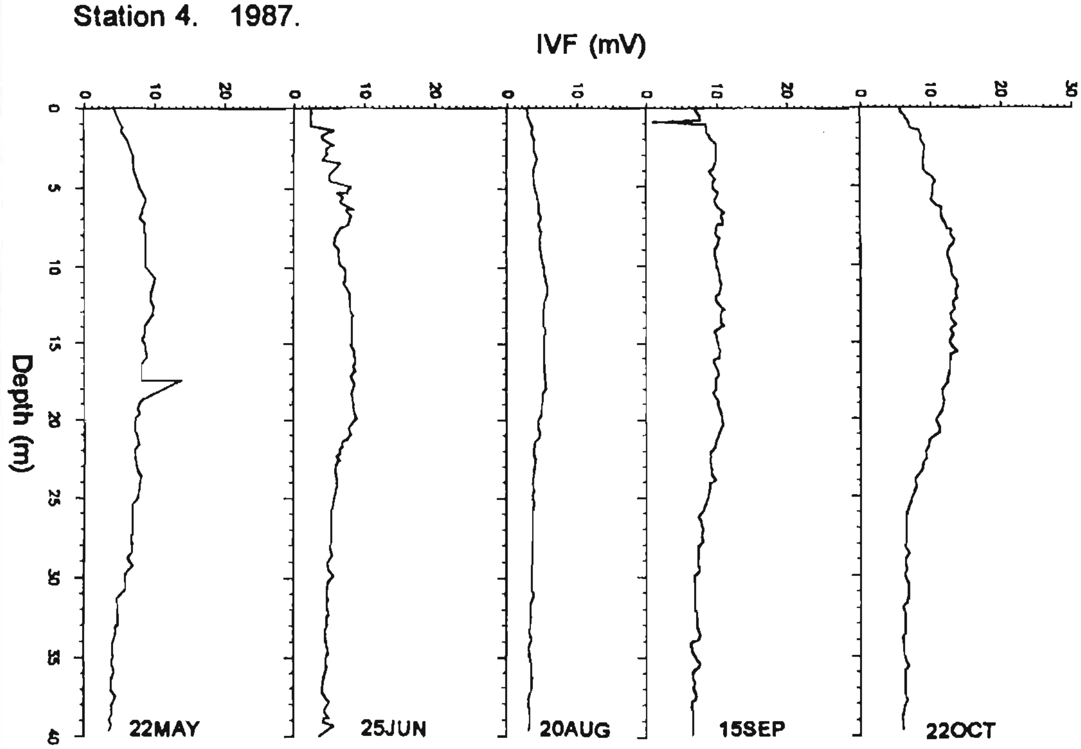


Fig 3. Variation of *in vivo* fluorescence with depth.

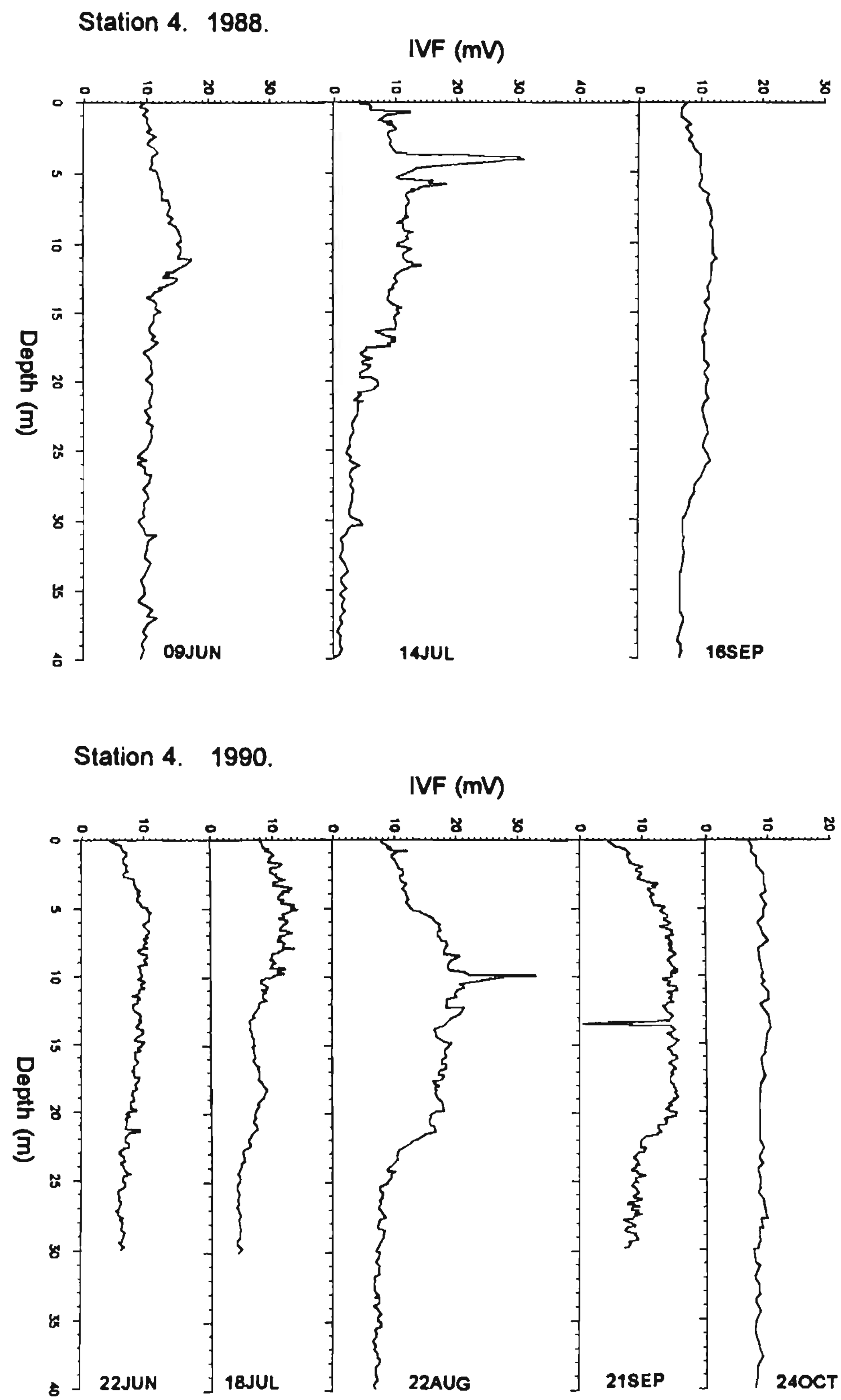
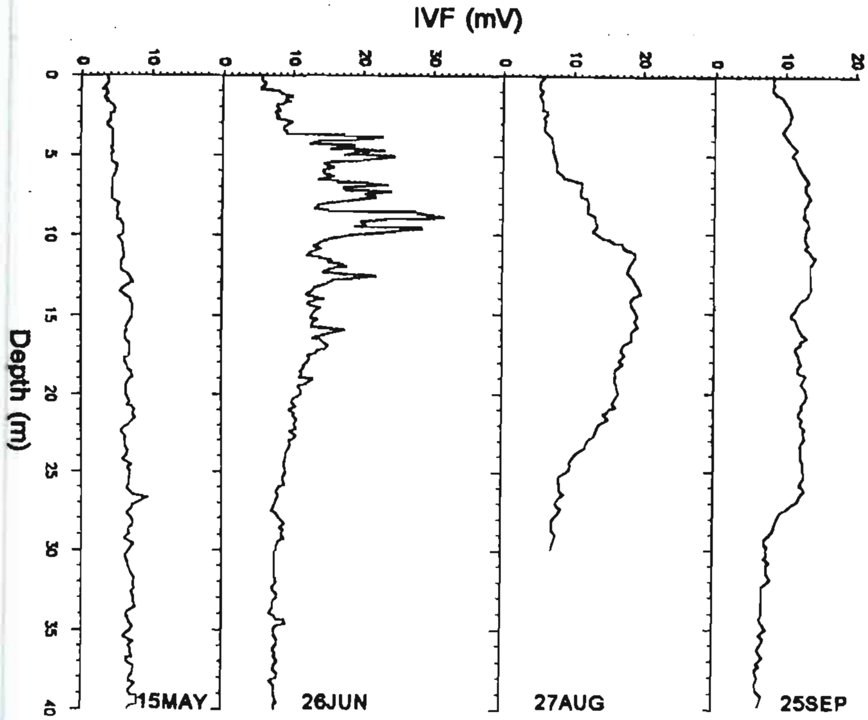


Fig 3. Variation of *in vivo* fluorescence with depth.

Station 5. 1986.



Station 5. 1987.

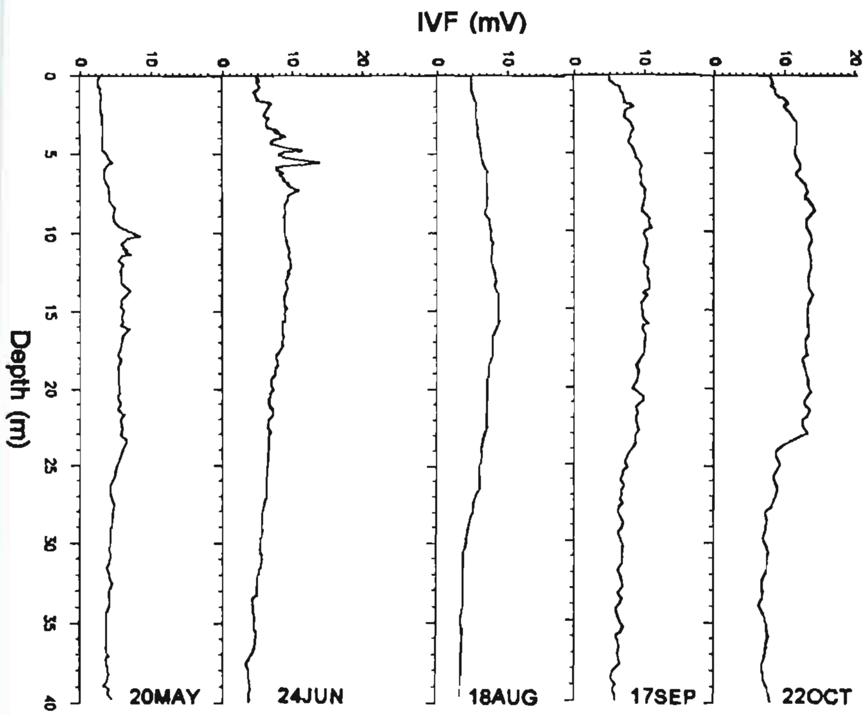


Fig 3. Variation of *in vivo* fluorescence with depth.

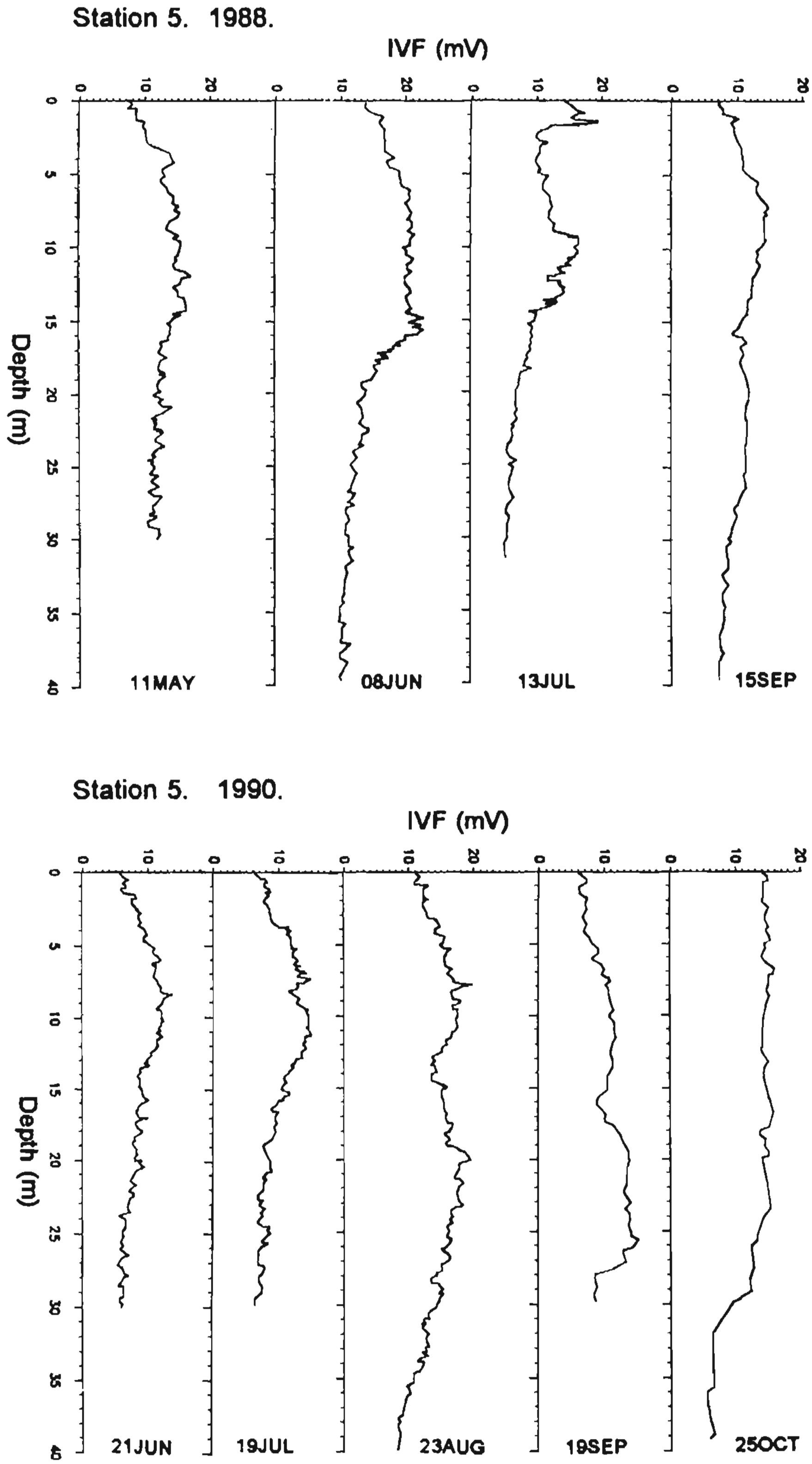
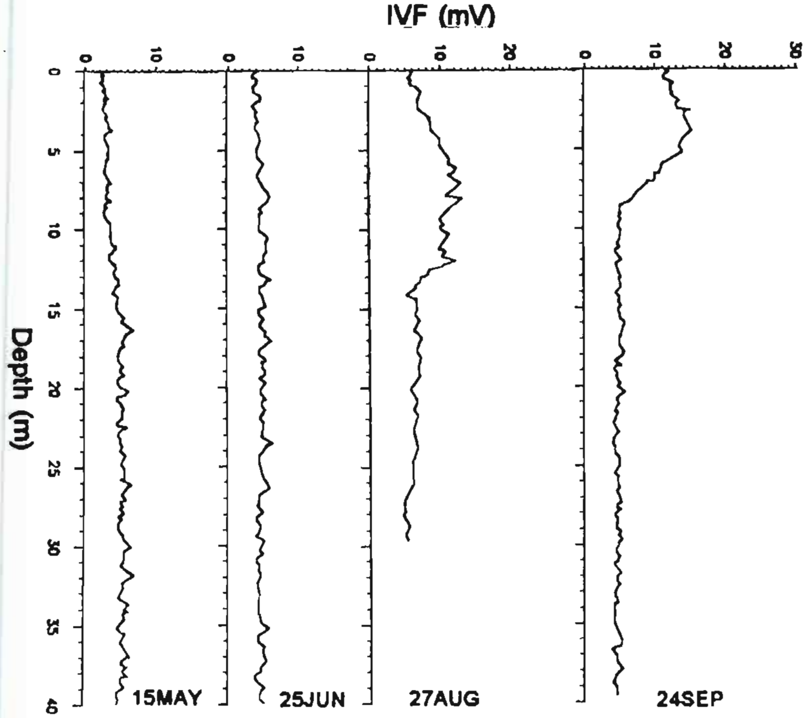


Fig 3. Variation of *in vivo* fluorescence with depth.

Station 6. 1986.



Station 6. 1987.

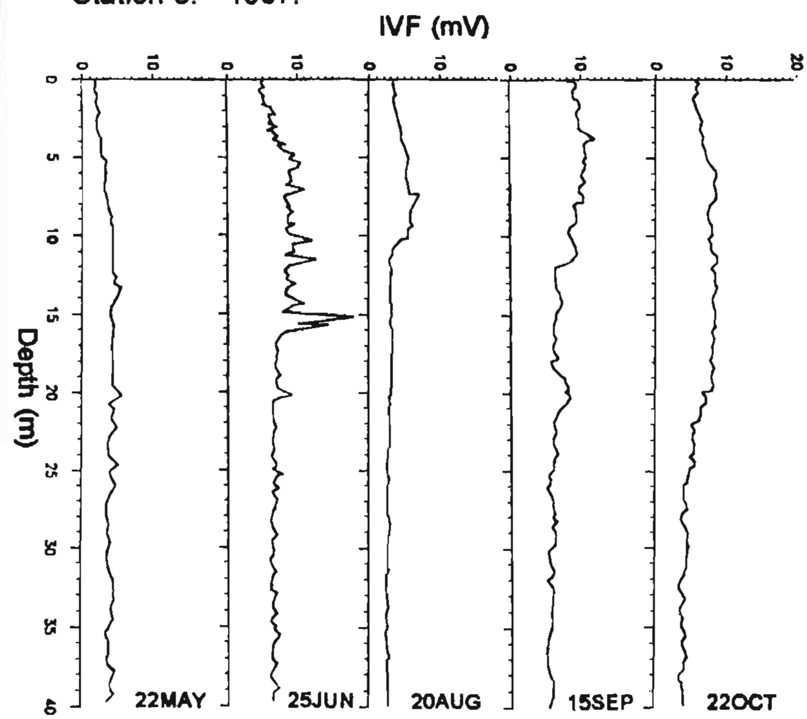


Fig 3. Variation of *in vivo* fluorescence with depth.

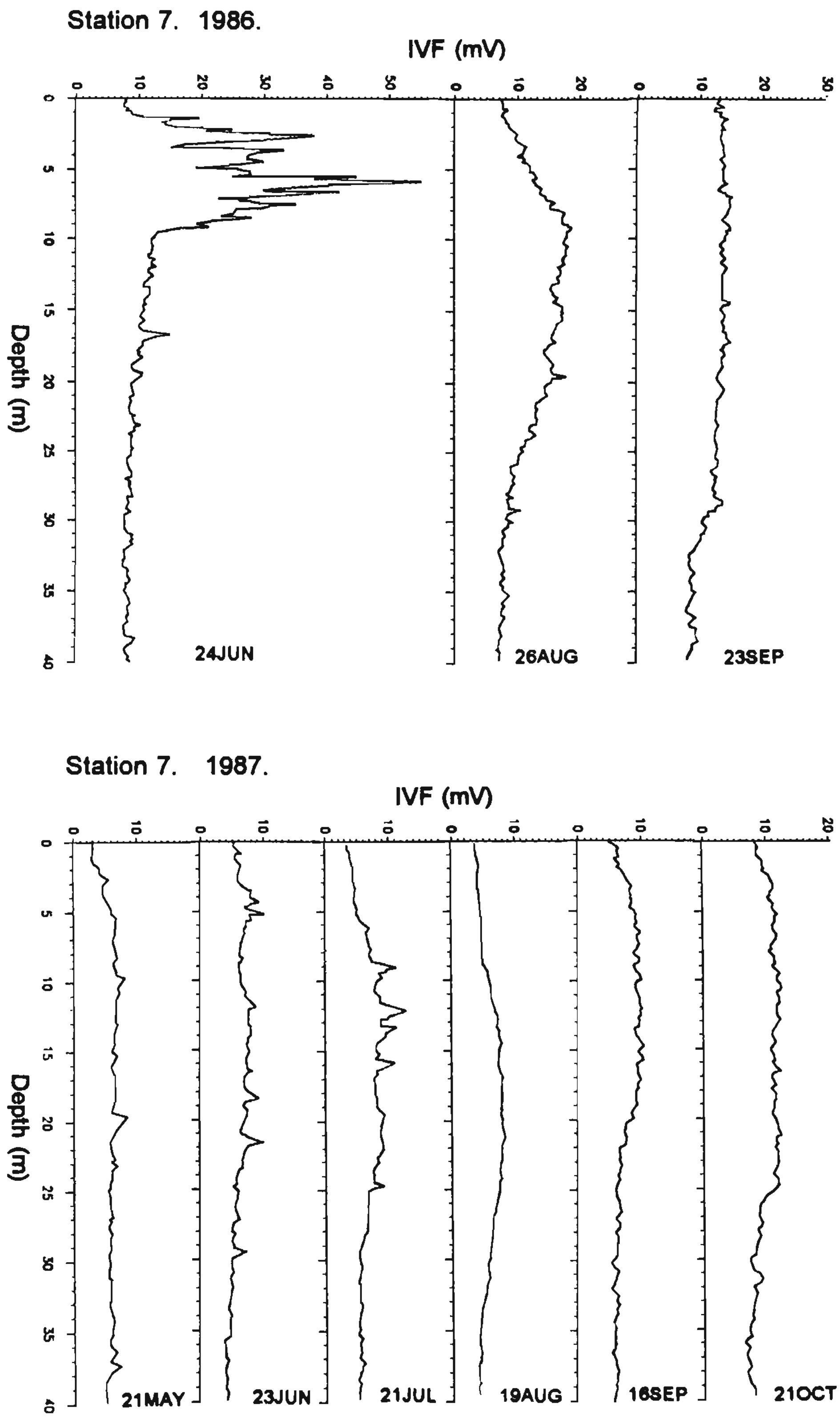


Fig 3. Variation of *in vivo* fluorescence with depth.

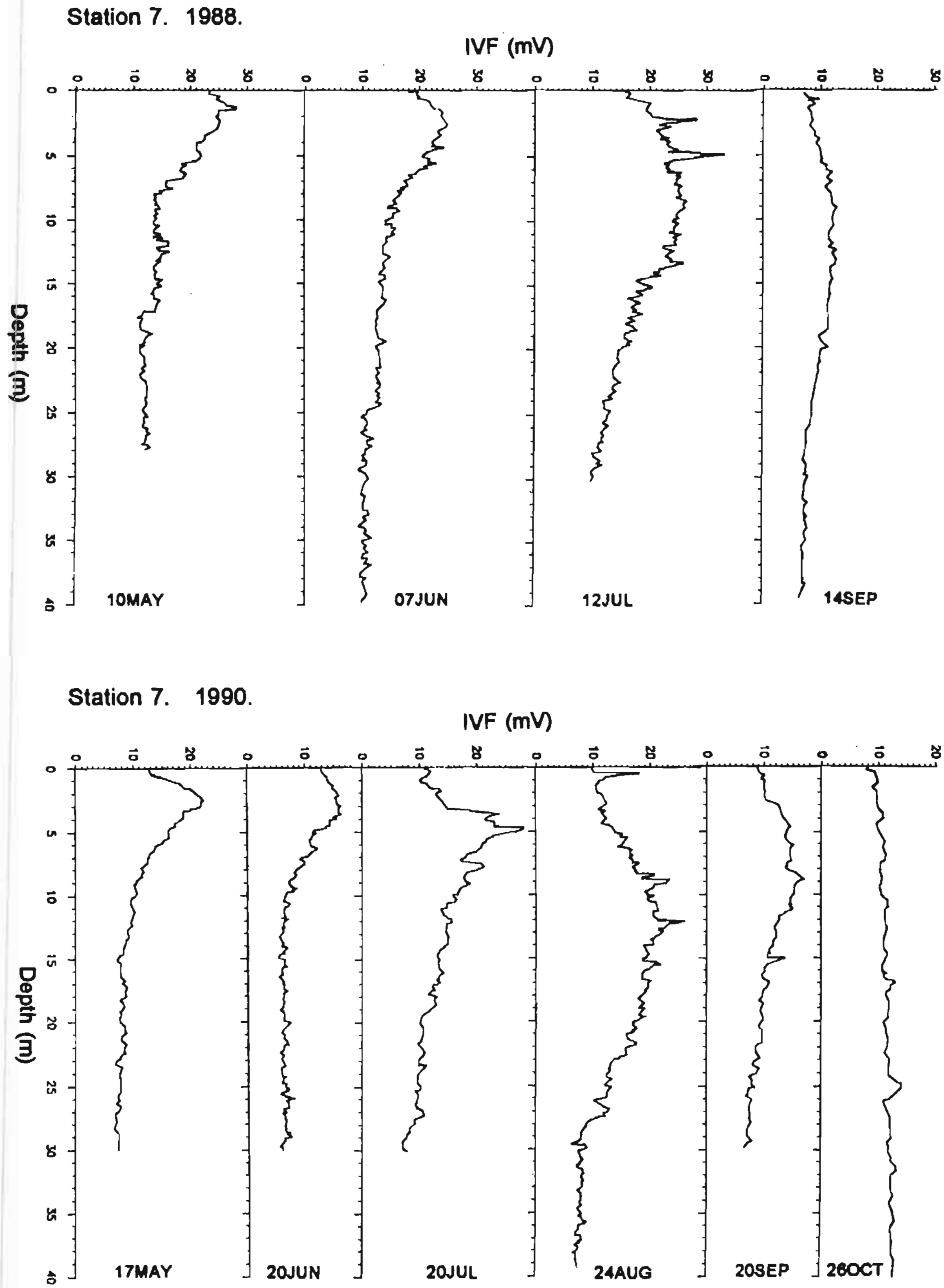
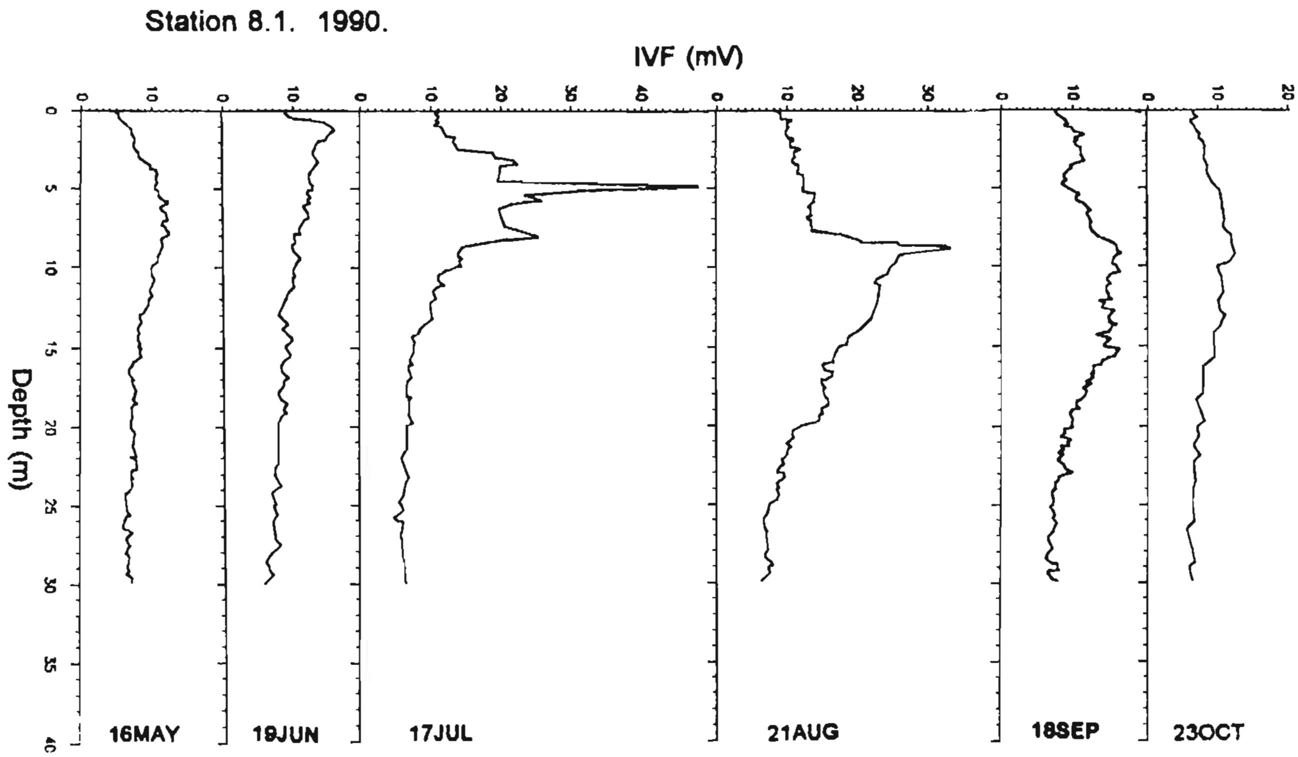


Fig 3. Variation of *in vivo* fluorescence with depth.



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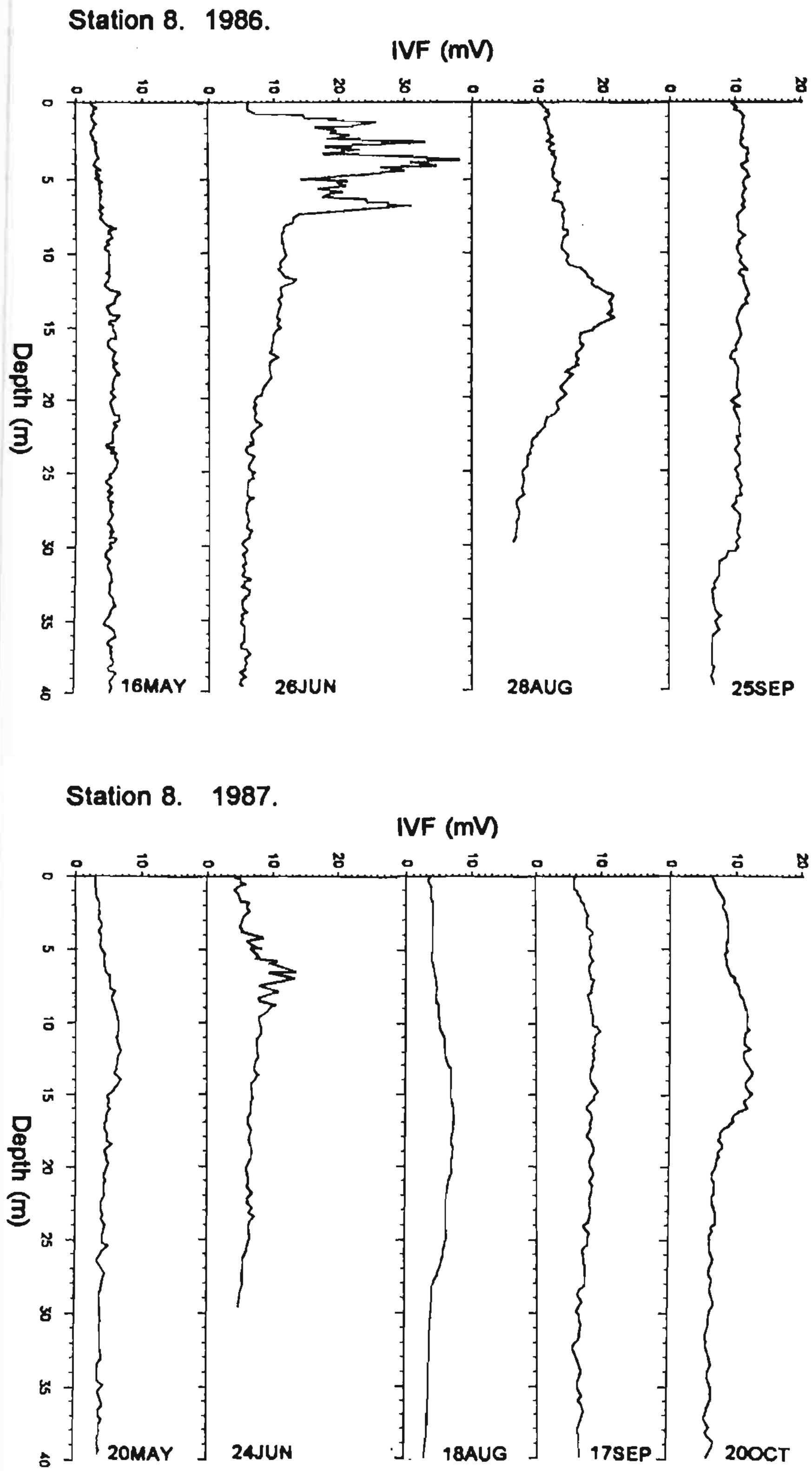
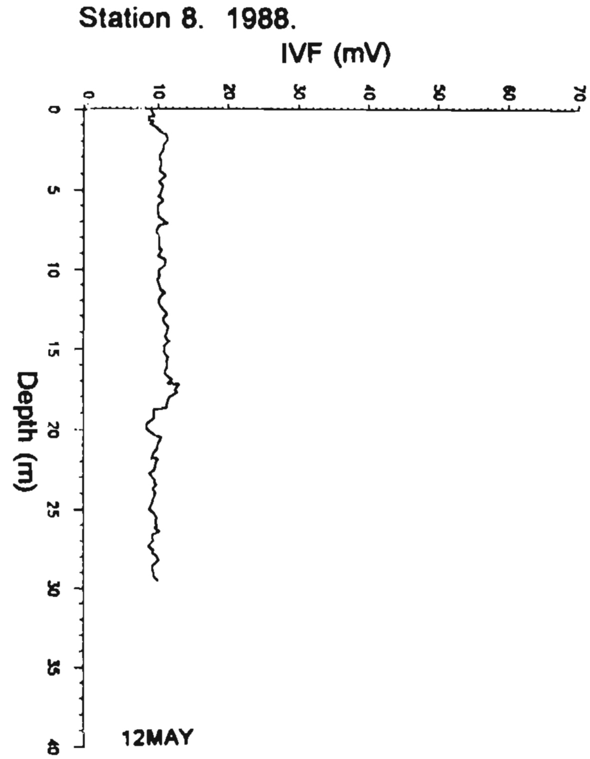


Fig 3. Variation of *in vivo* fluorescence with depth.



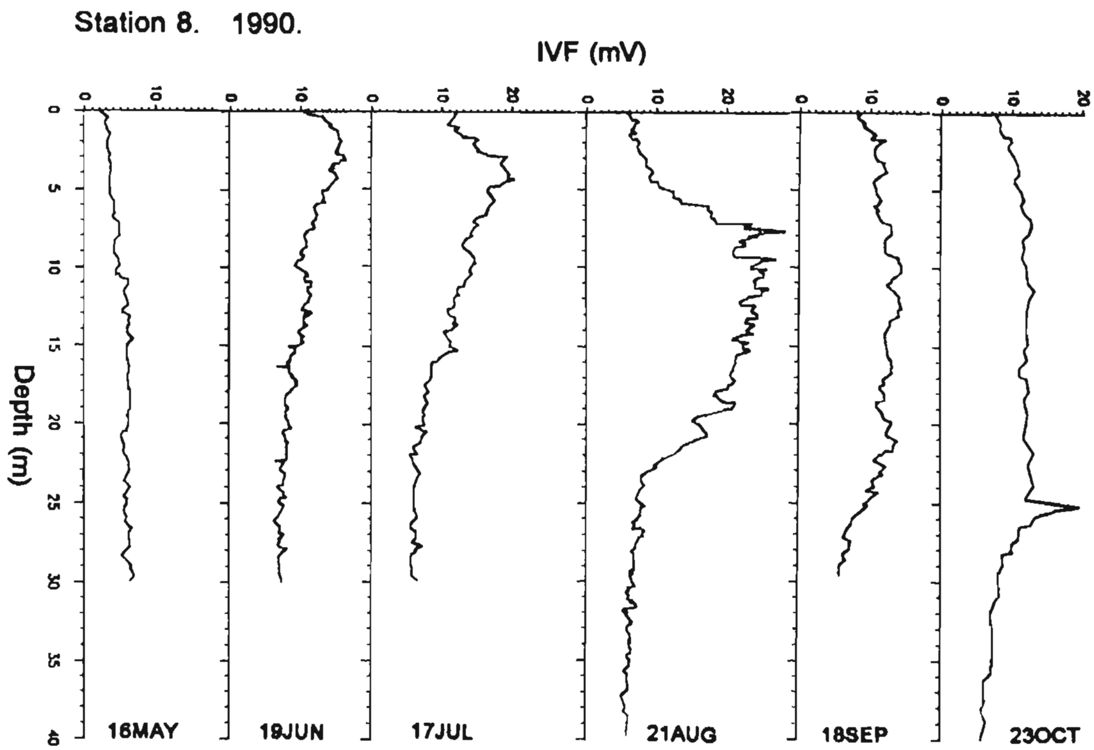
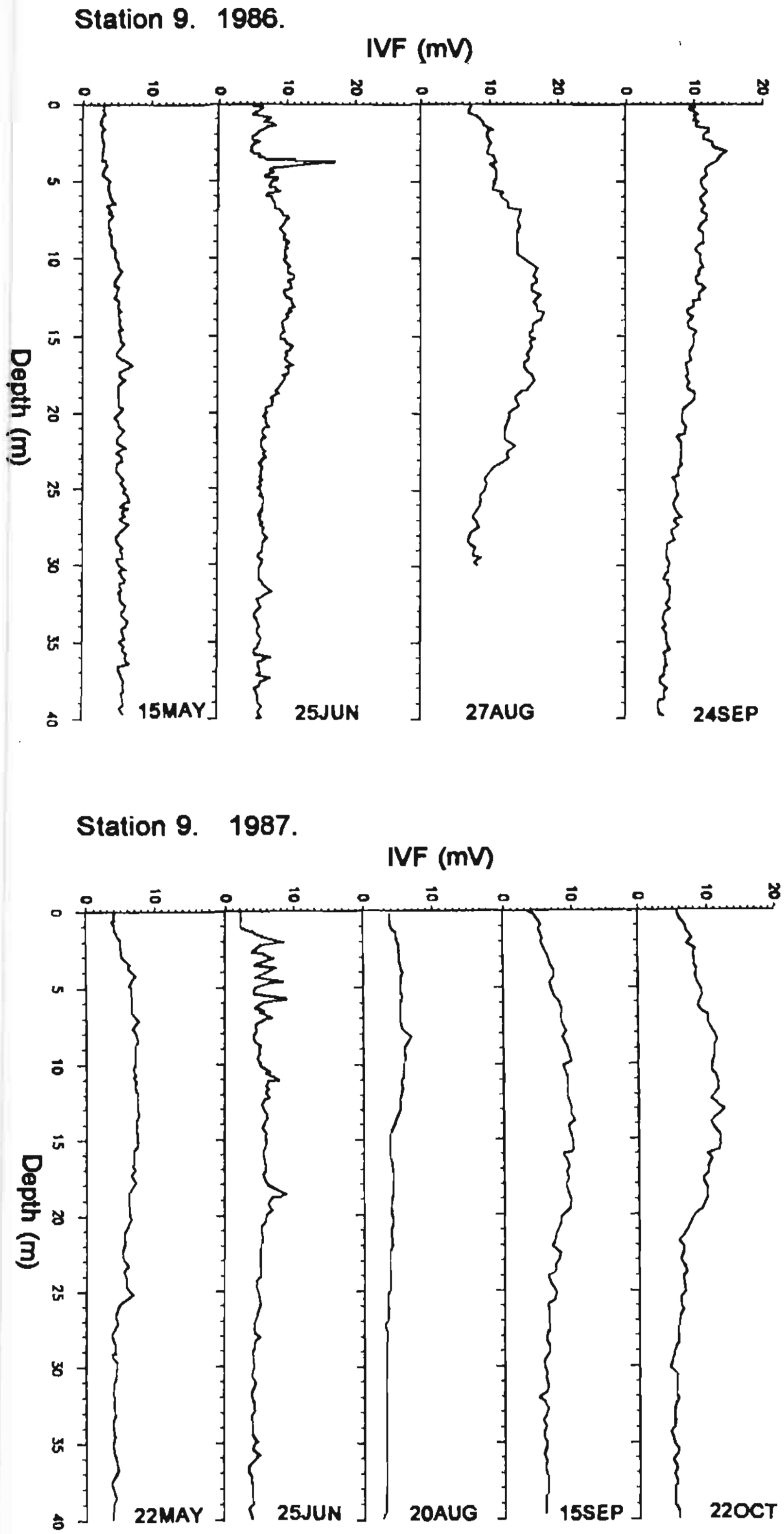


Fig 3. Variation of *in vivo* fluorescence with depth.



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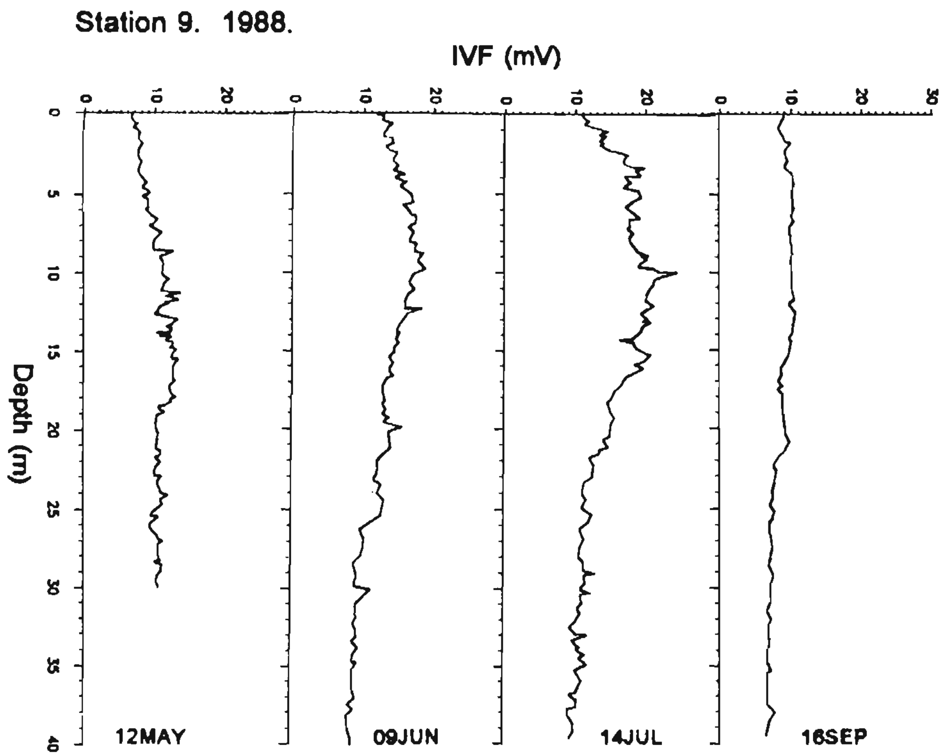


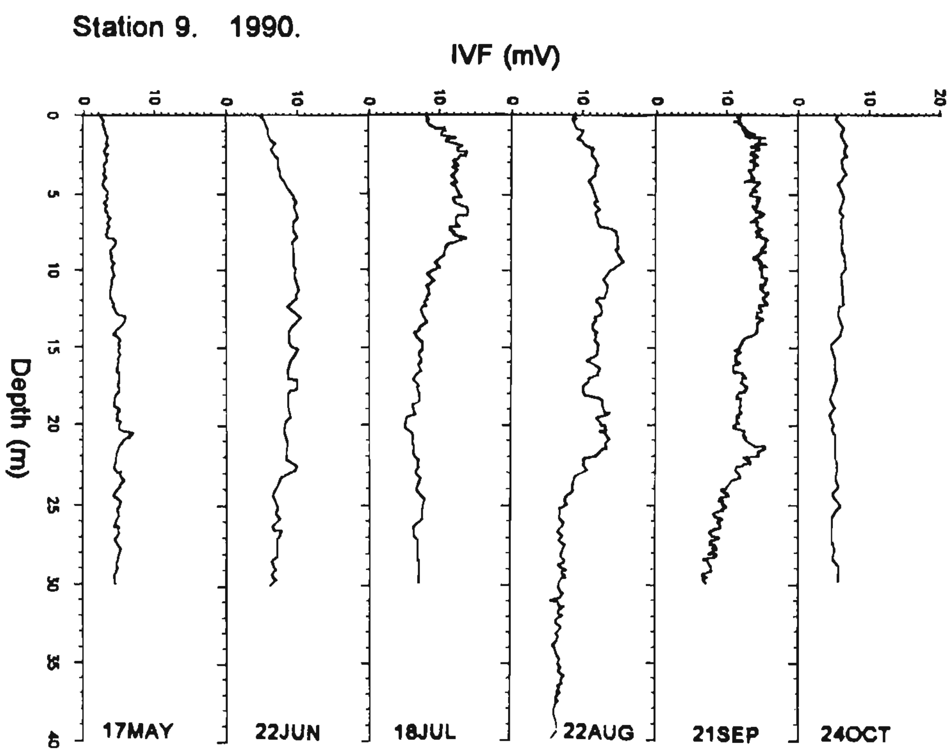
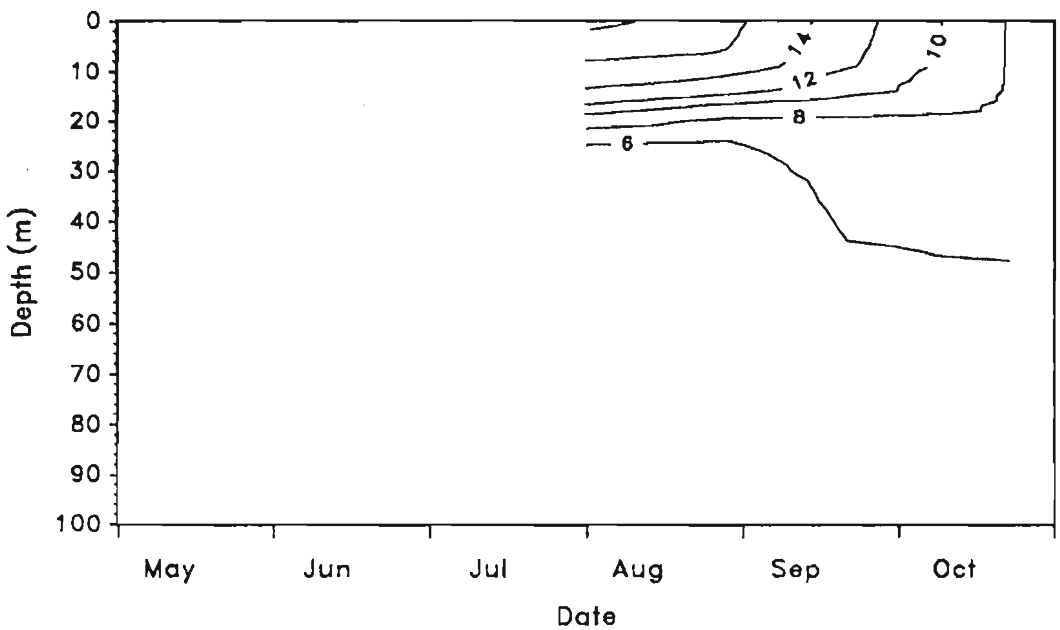


Fig 3. Variation of *in vivo* fluorescence with depth.

Station=1.0 YEAR=1985



Station=1.0 YEAR=1986

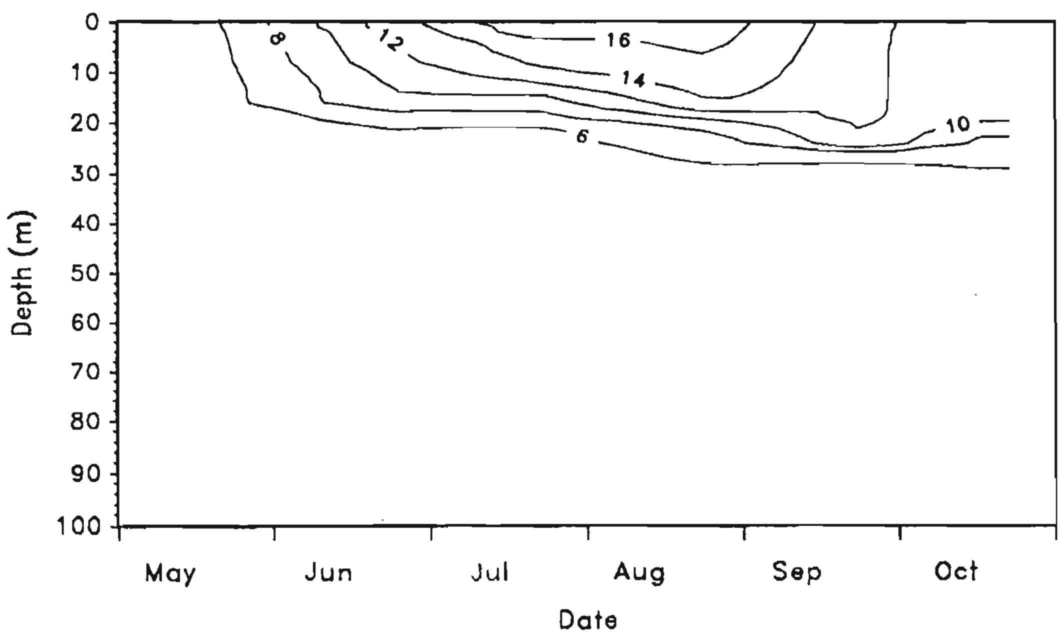
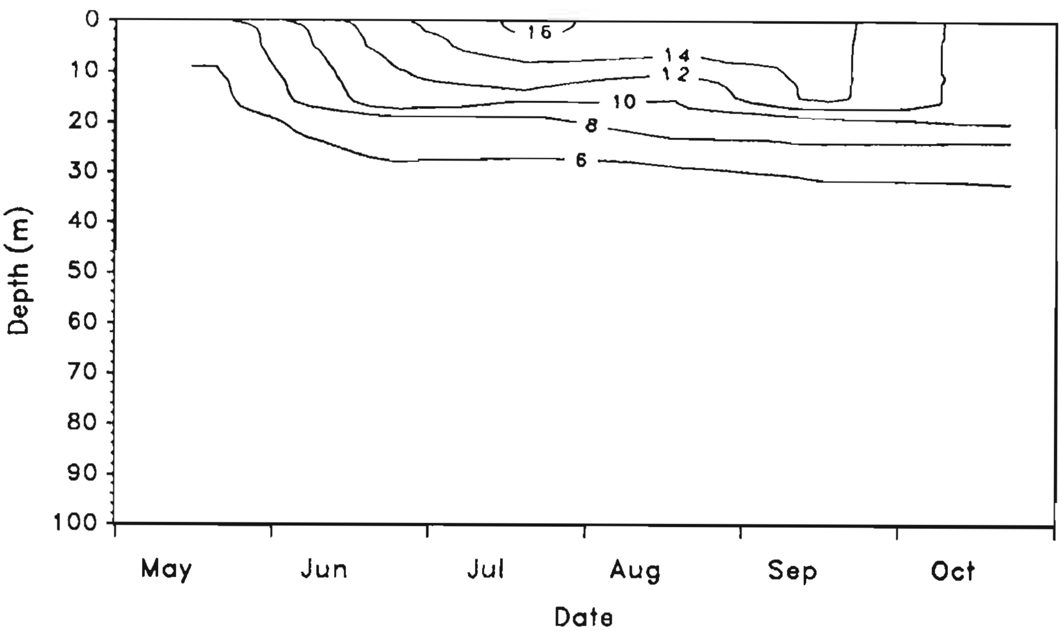


Fig 4. Seasonal variation in thermal structure.

Station=1.0 YEAR=1987



Station=1.0 YEAR=1988

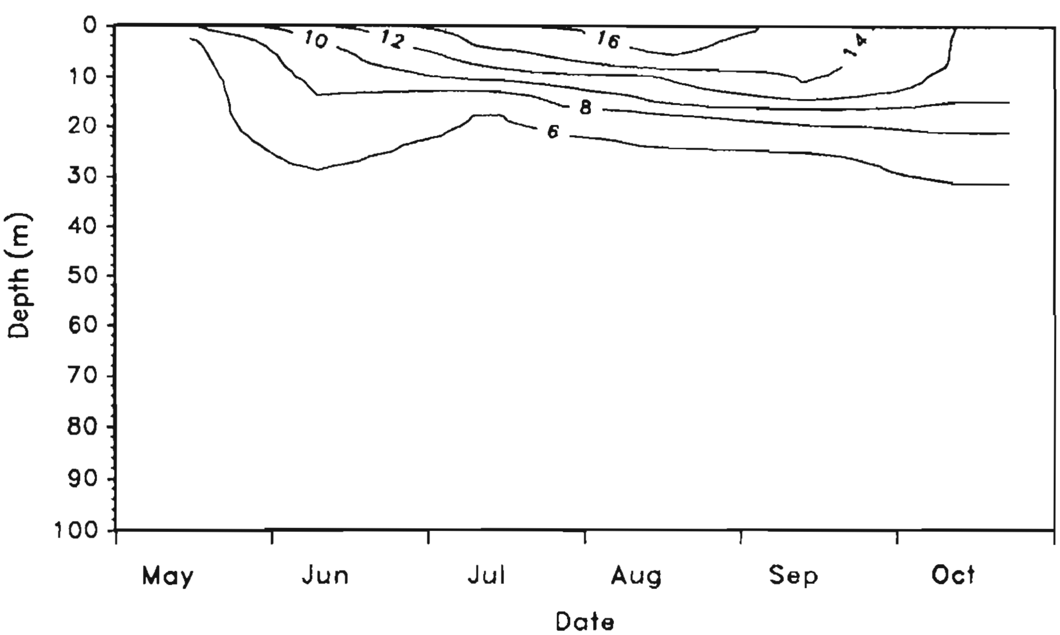
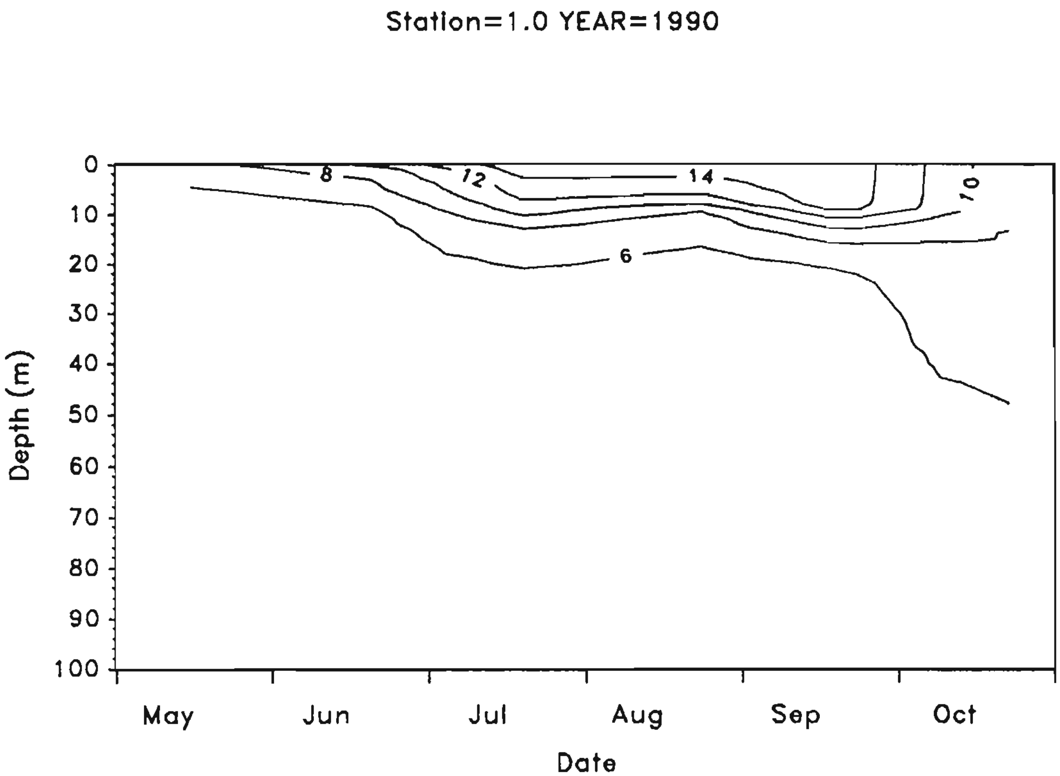


Fig 4. Seasonal variation in thermal structure.



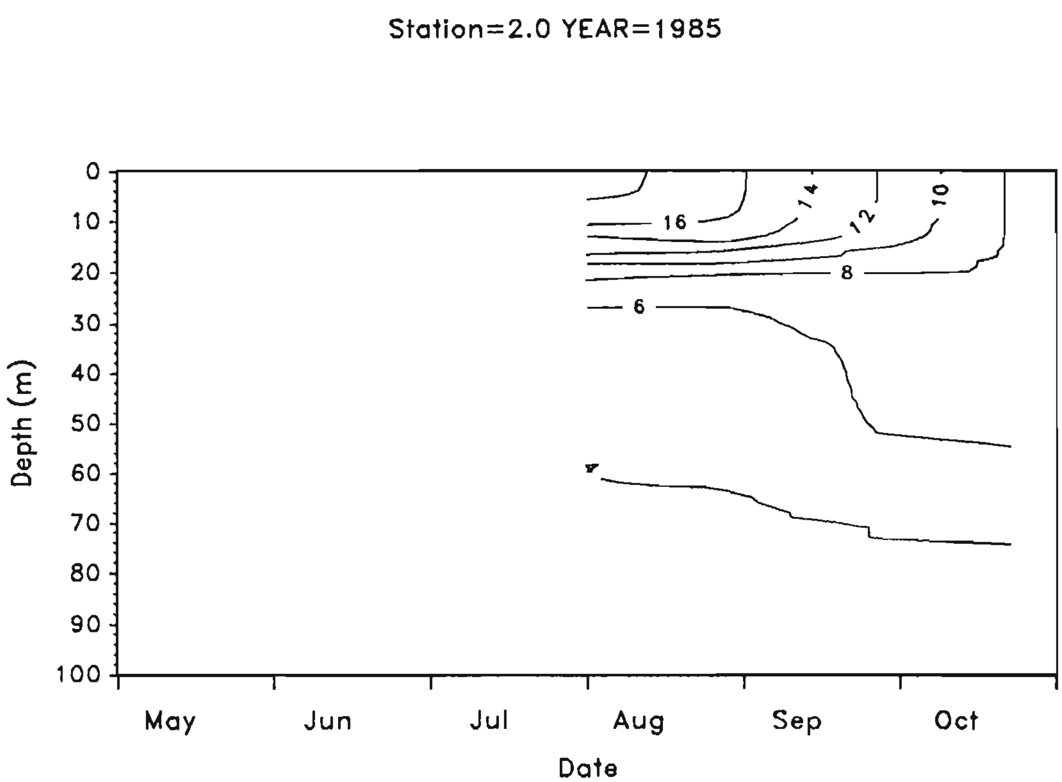
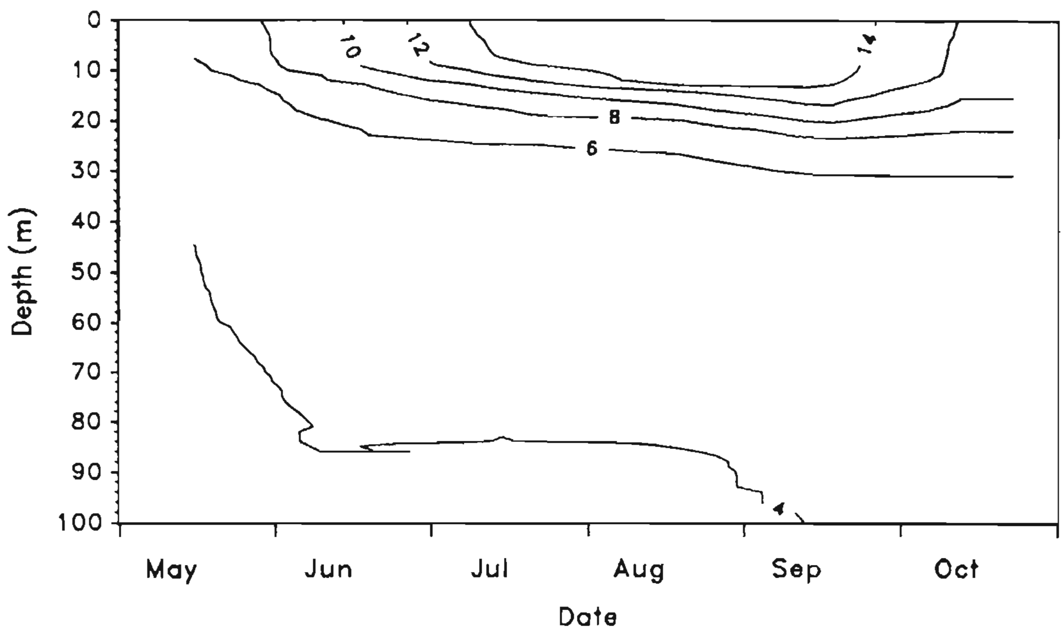


Fig 4. Seasonal variation in thermal structure.

Station=3.0 YEAR=1988



Station=3.0 YEAR=1990

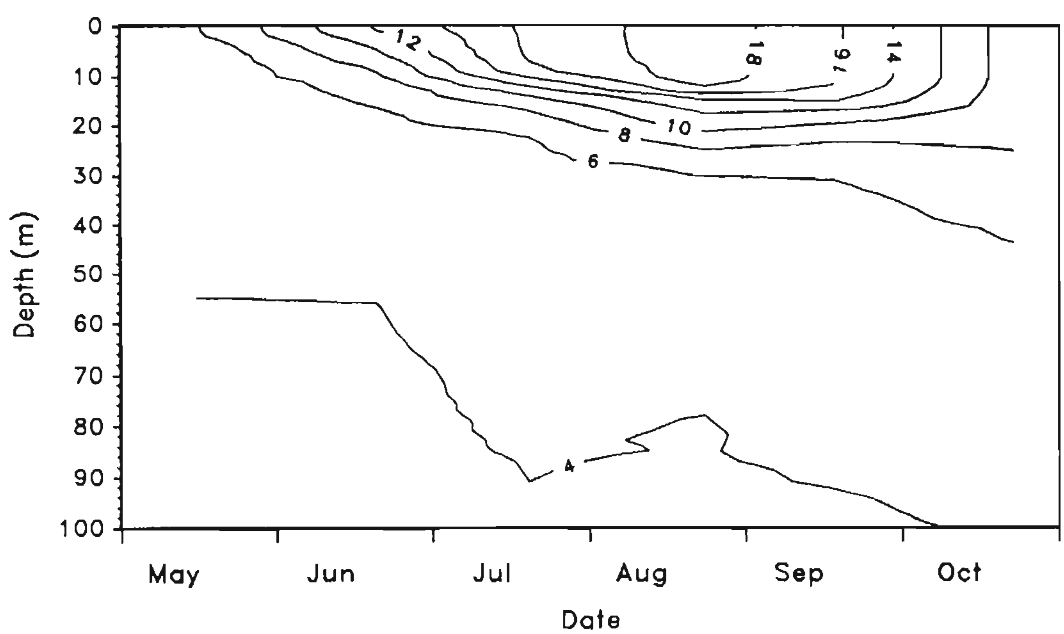
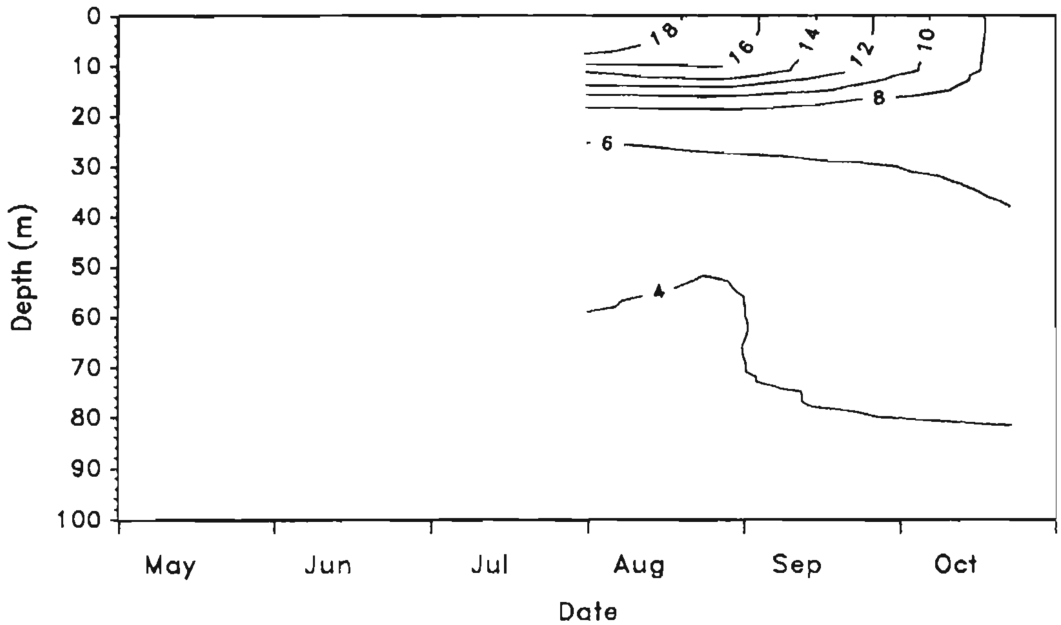


Fig 4. Seasonal variation in thermal structure.

Station=4.0 YEAR=1985



Station=4.0 YEAR=1986

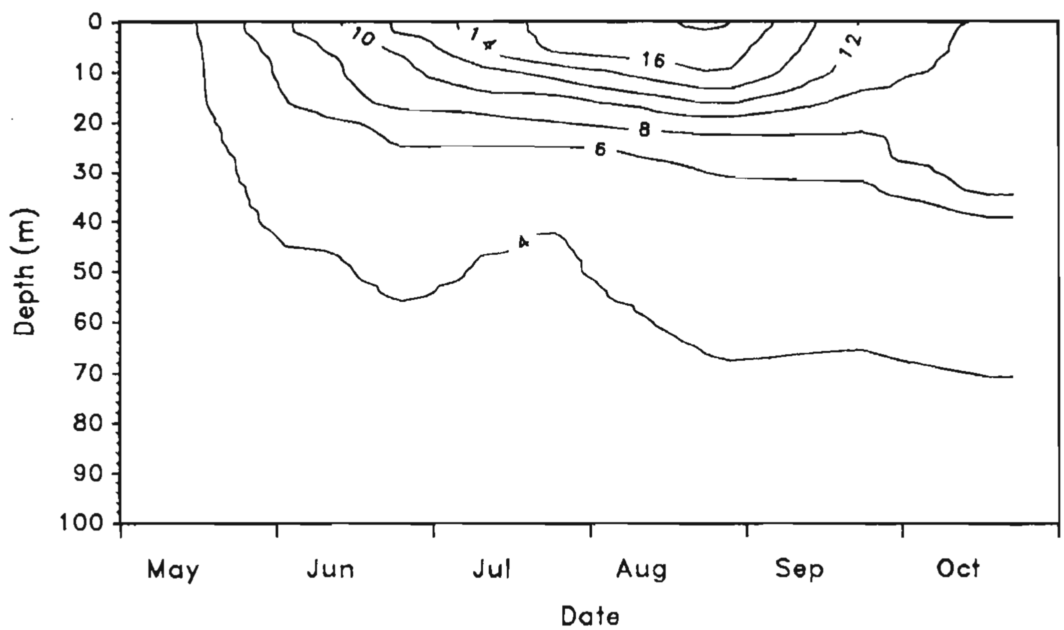
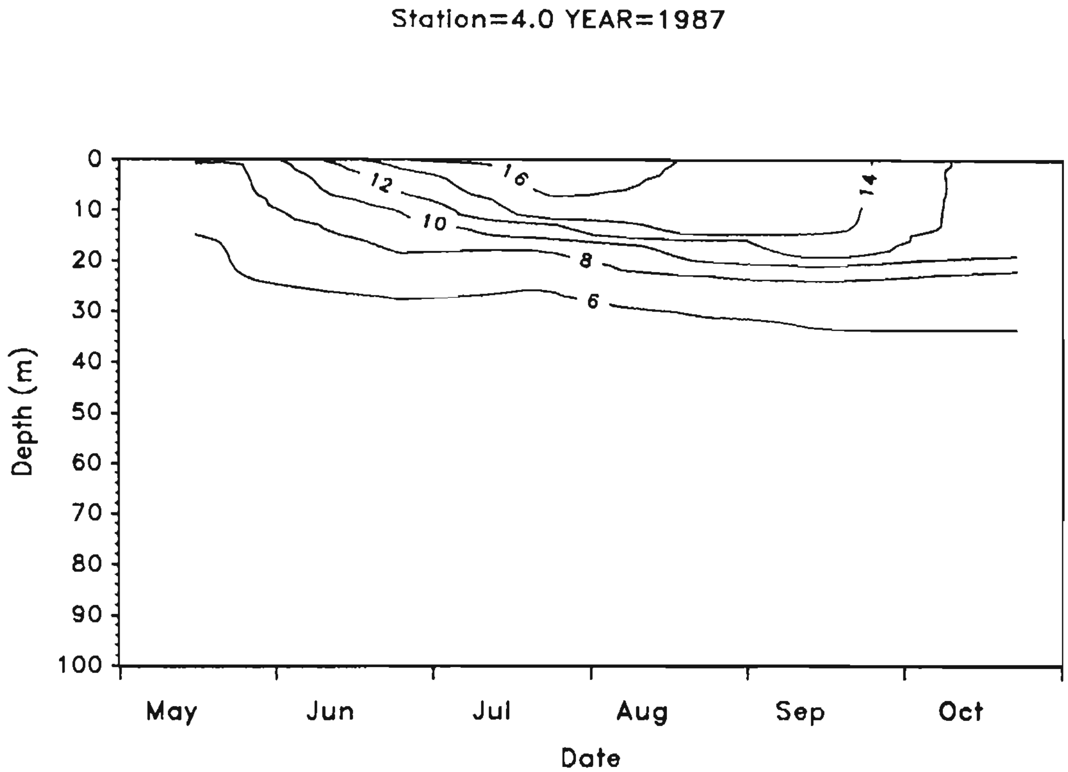


Fig 4. Seasonal variation in thermal structure.



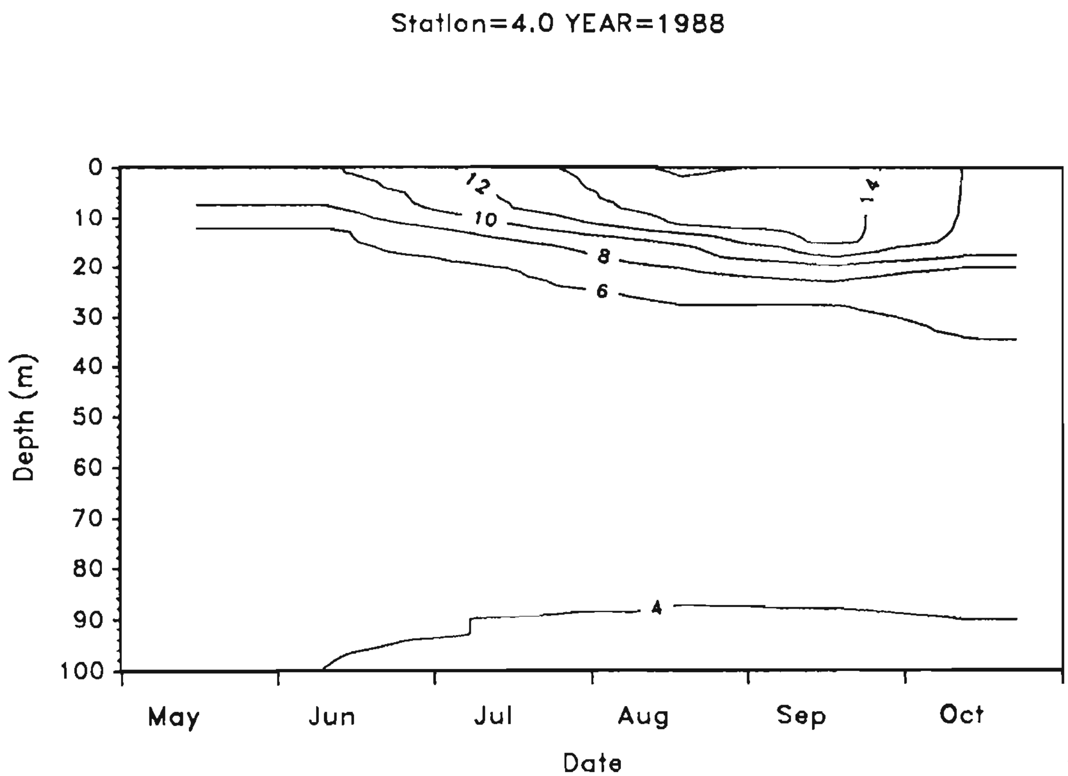
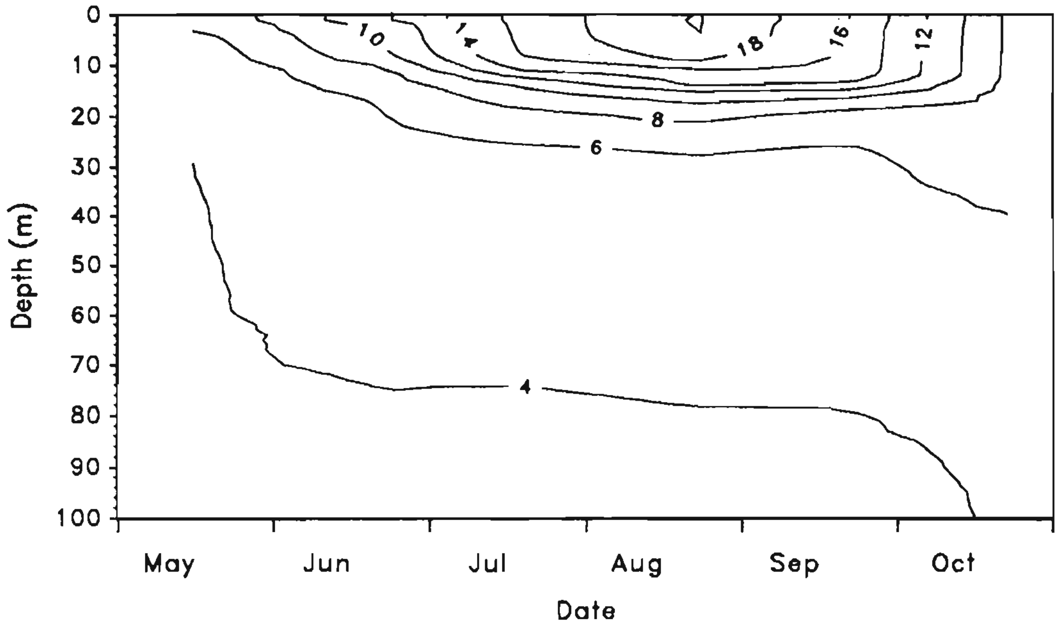


Fig 4. **Seasonal variation in thermal structure.**

Station=4.0 YEAR=1990



Station=5.0 YEAR=1985

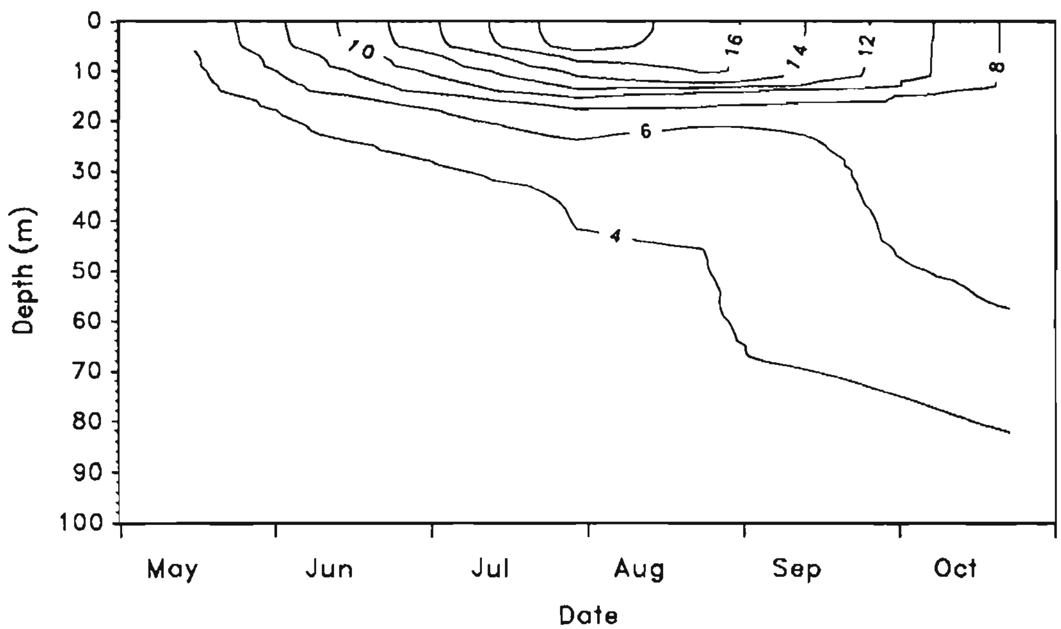
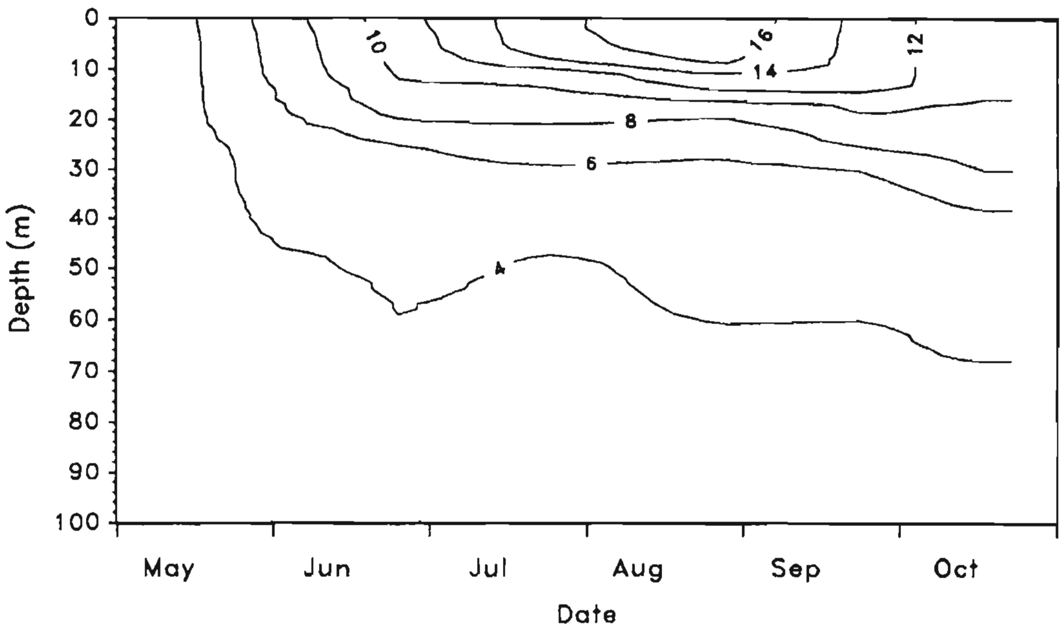


Fig 4. Seasonal variation in thermal structure.

Station=5.0 YEAR=1986



Station=5.0 YEAR=1987

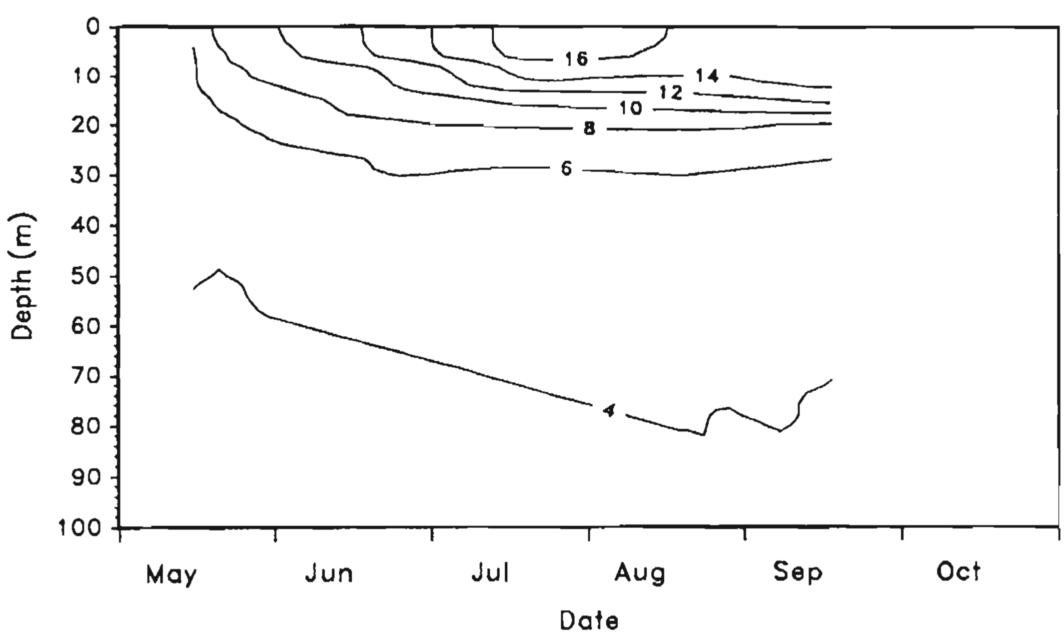
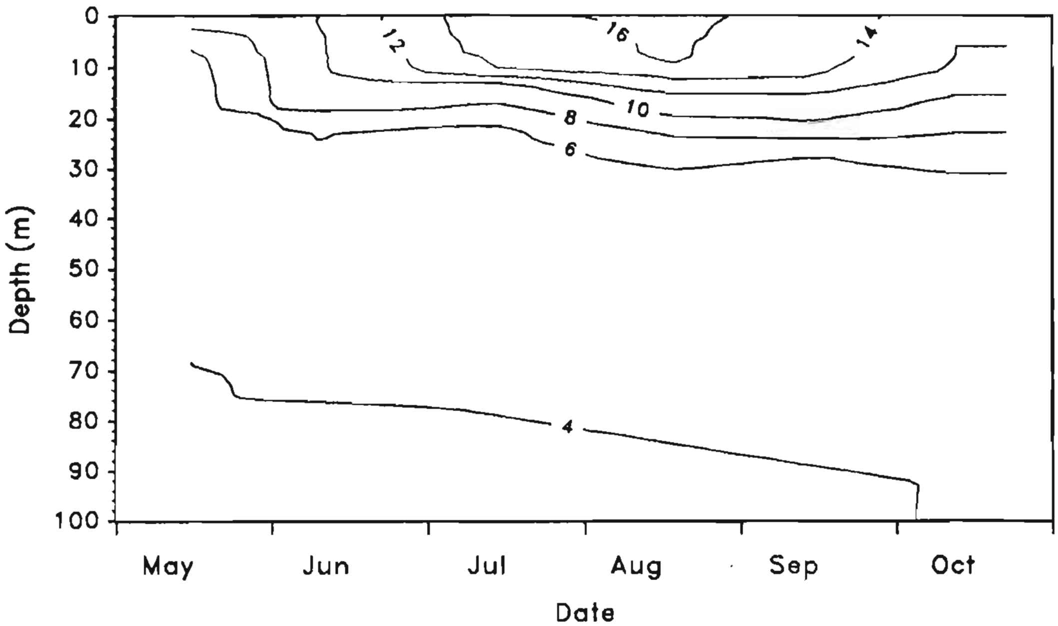


Fig 4. Seasonal variation in thermal structure.

Station=5.0 YEAR=1988



Station=5.0 YEAR=1990

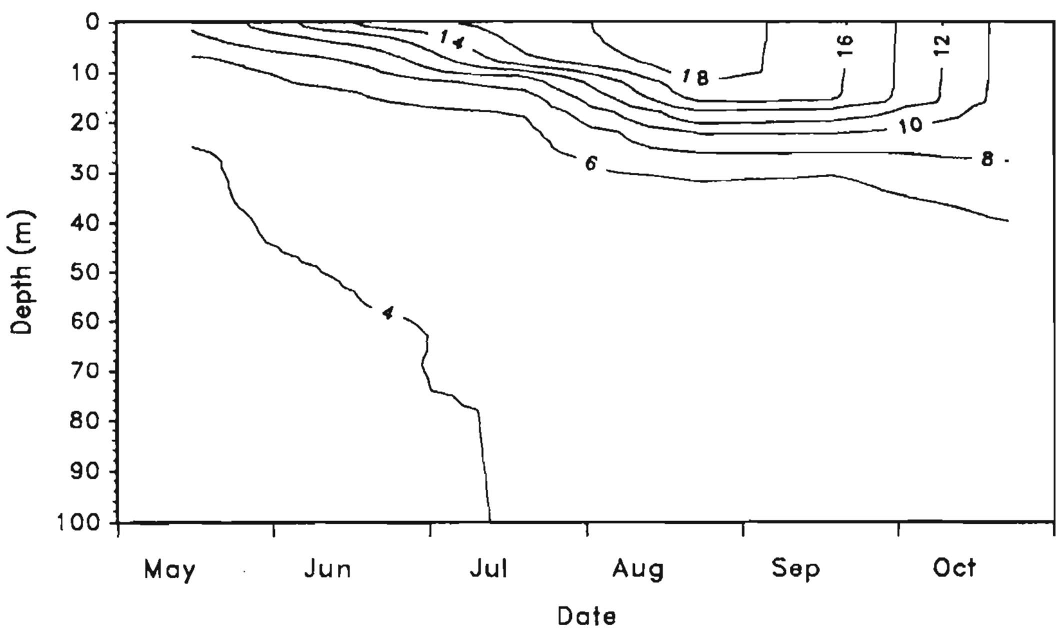
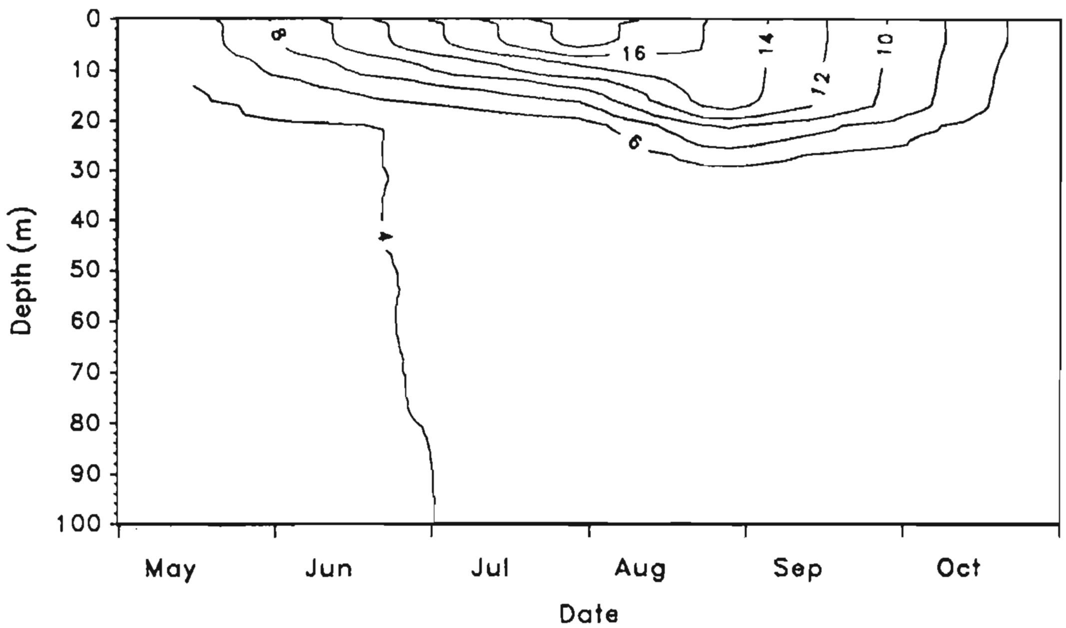


Fig 4. Seasonal variation in thermal structure.

Station=6.0 YEAR=1985



Station=6.0 YEAR=1986

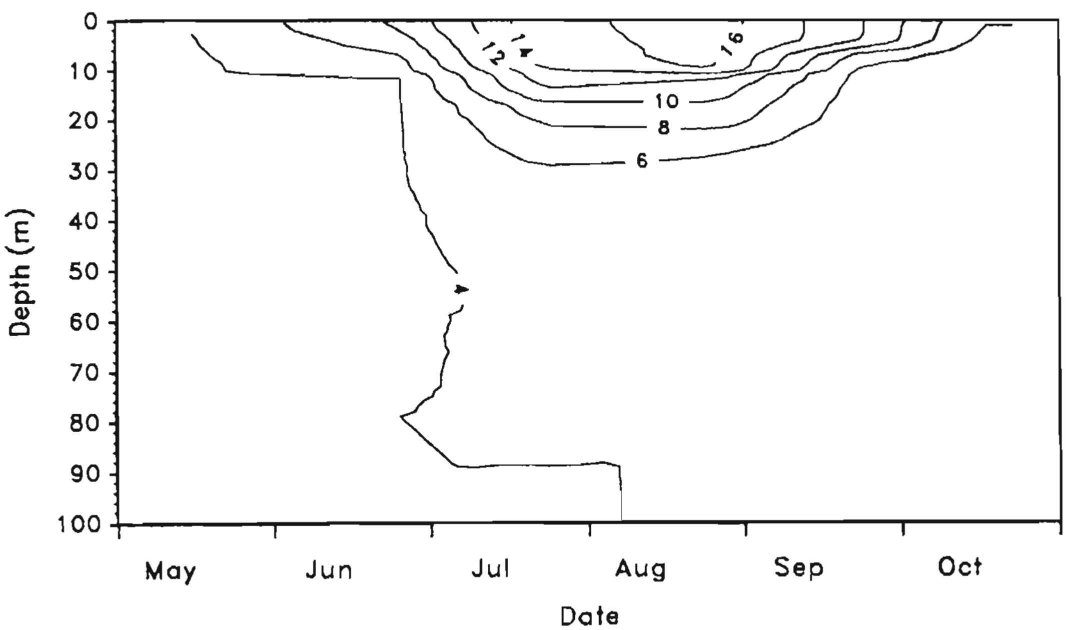


Fig 4. Seasonal variation in thermal structure.

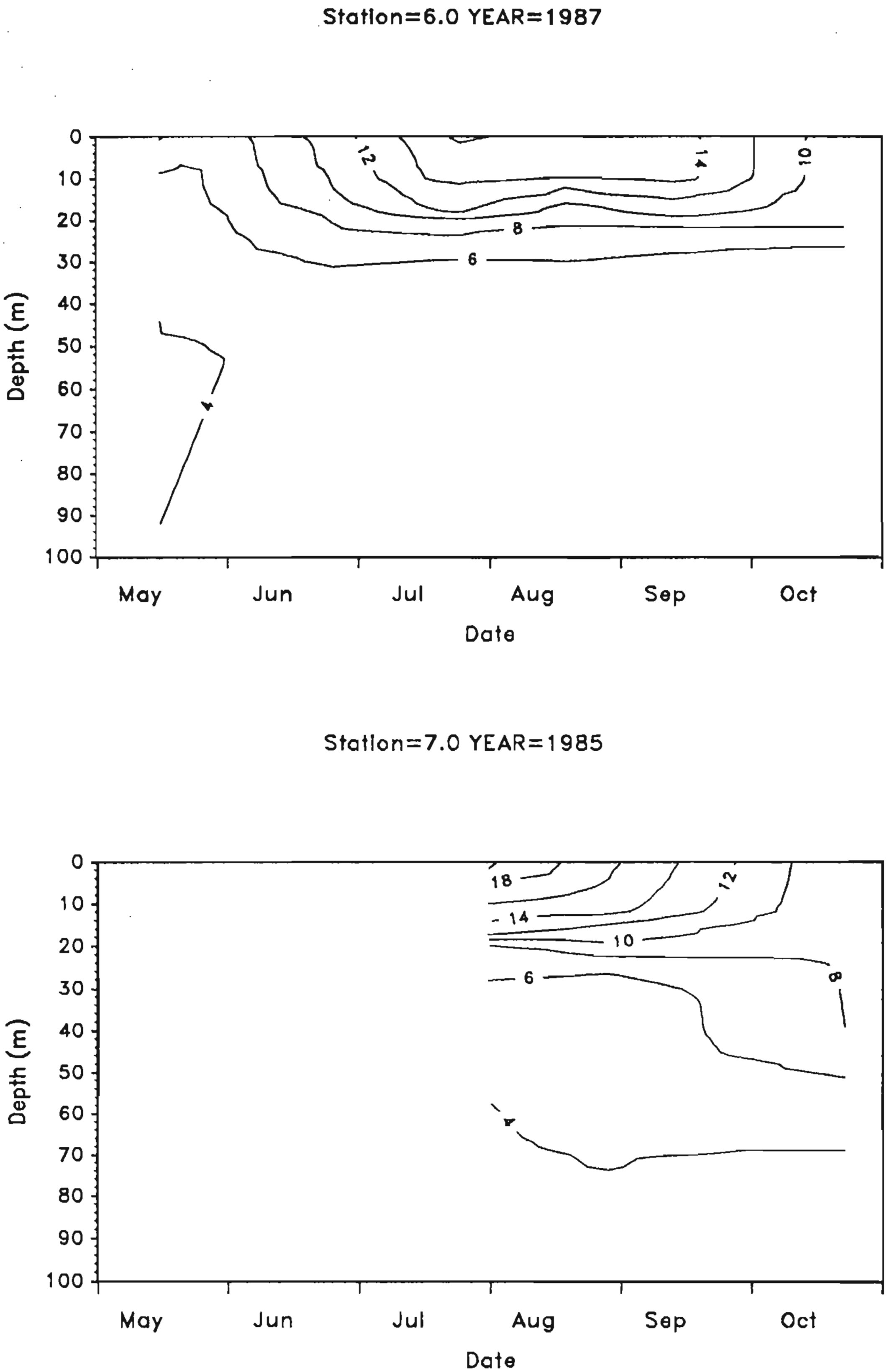
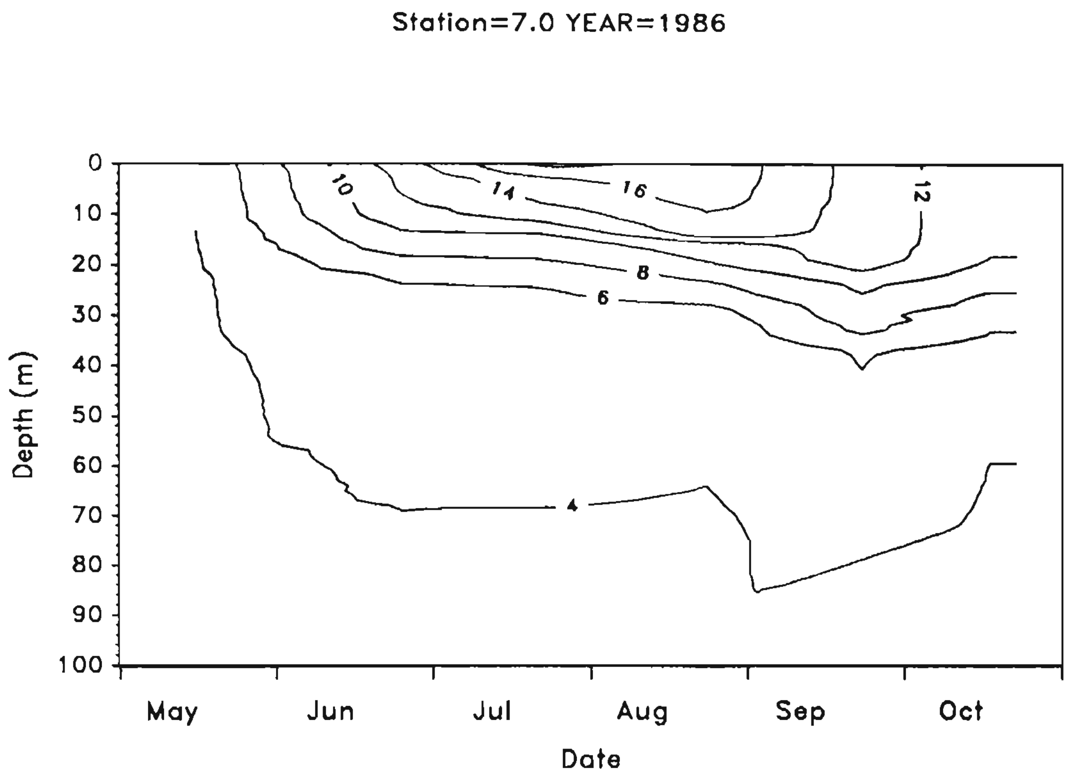


Fig 4. Seasonal variation in thermal structure.



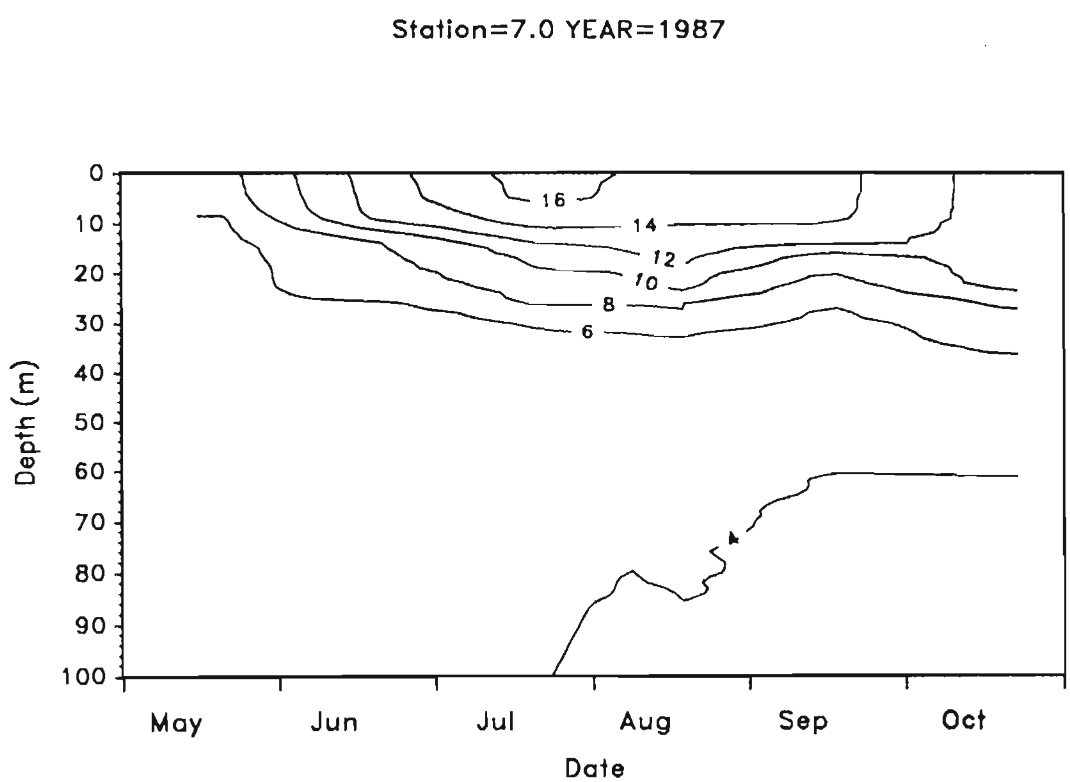
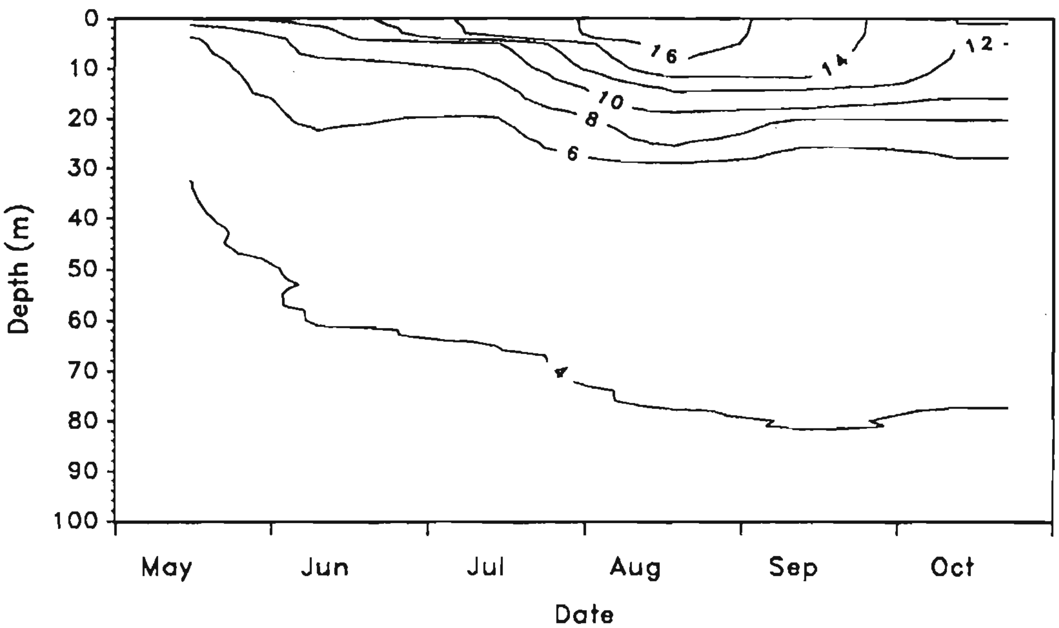


Fig 4. Seasonal variation in thermal structure.

Station=7.0 YEAR=1988



Station=7.0 YEAR=1990

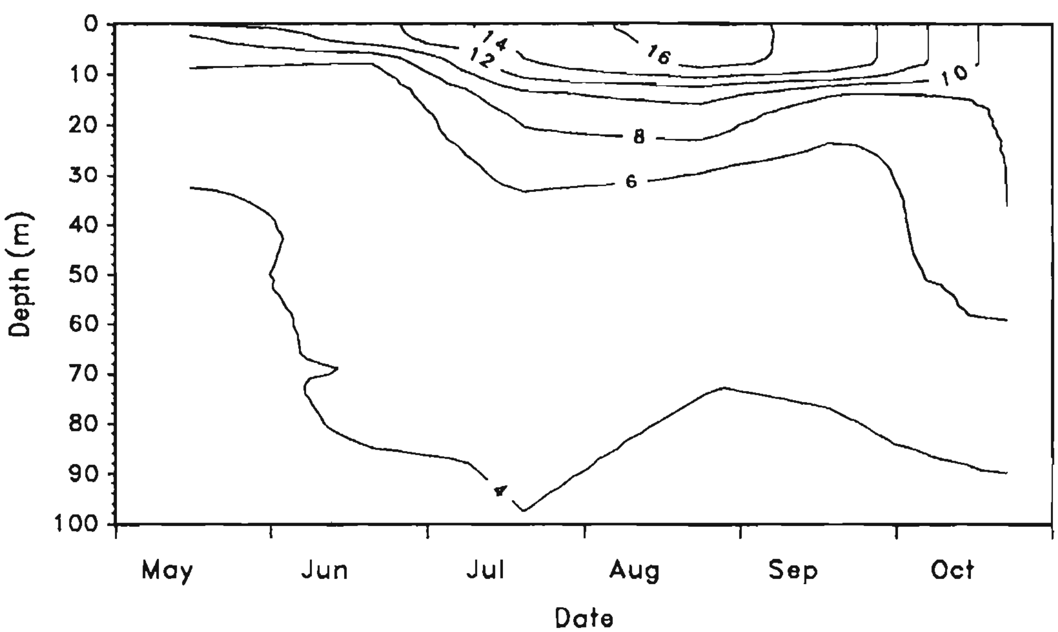
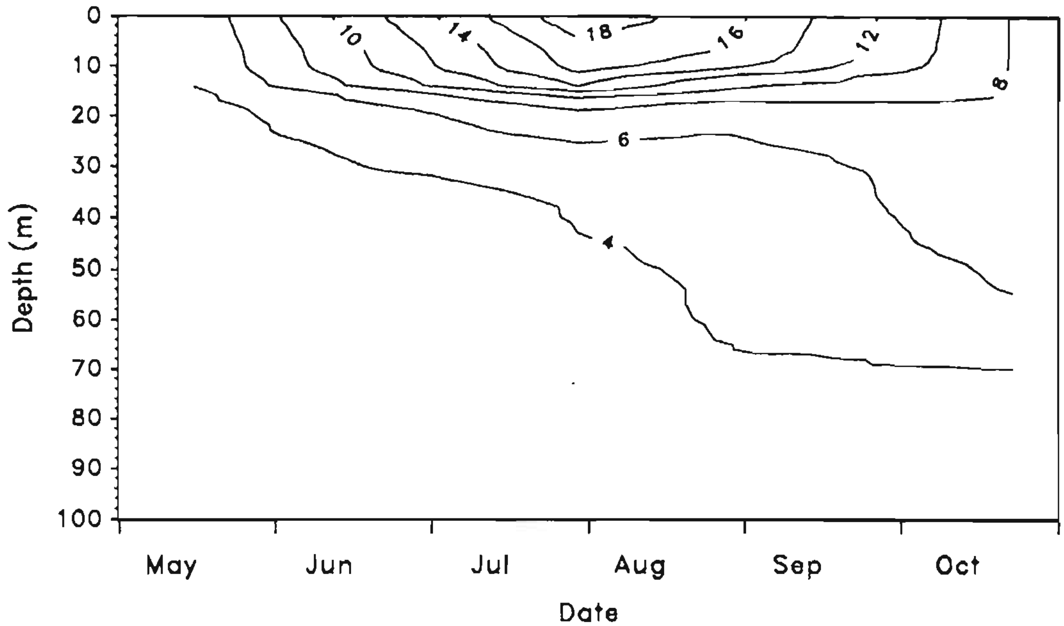


Fig 4. Seasonal variation in thermal structure.

Station=8.0 YEAR=1985



Station=8.0 YEAR=1986

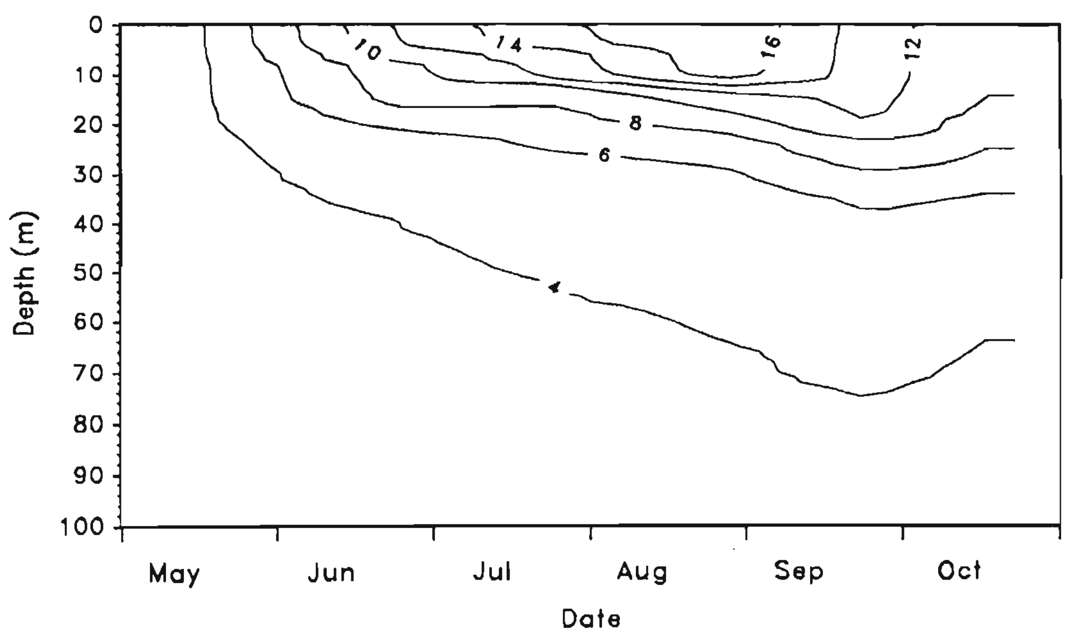
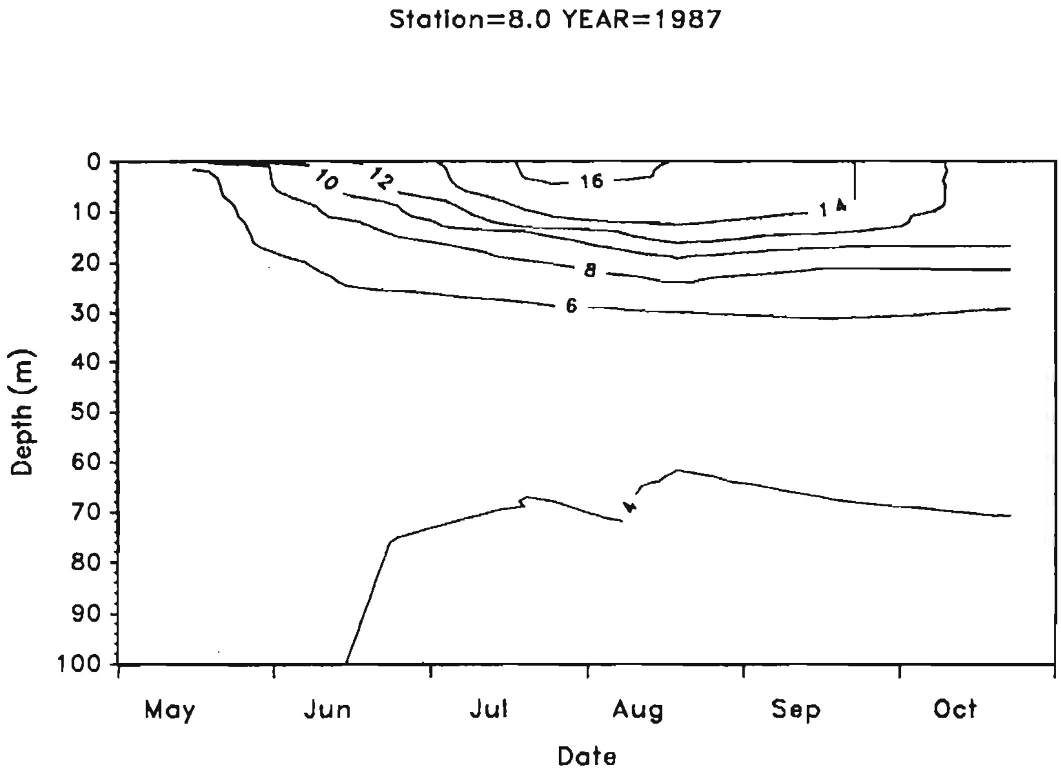


Fig 4. Seasonal variation in thermal structure.



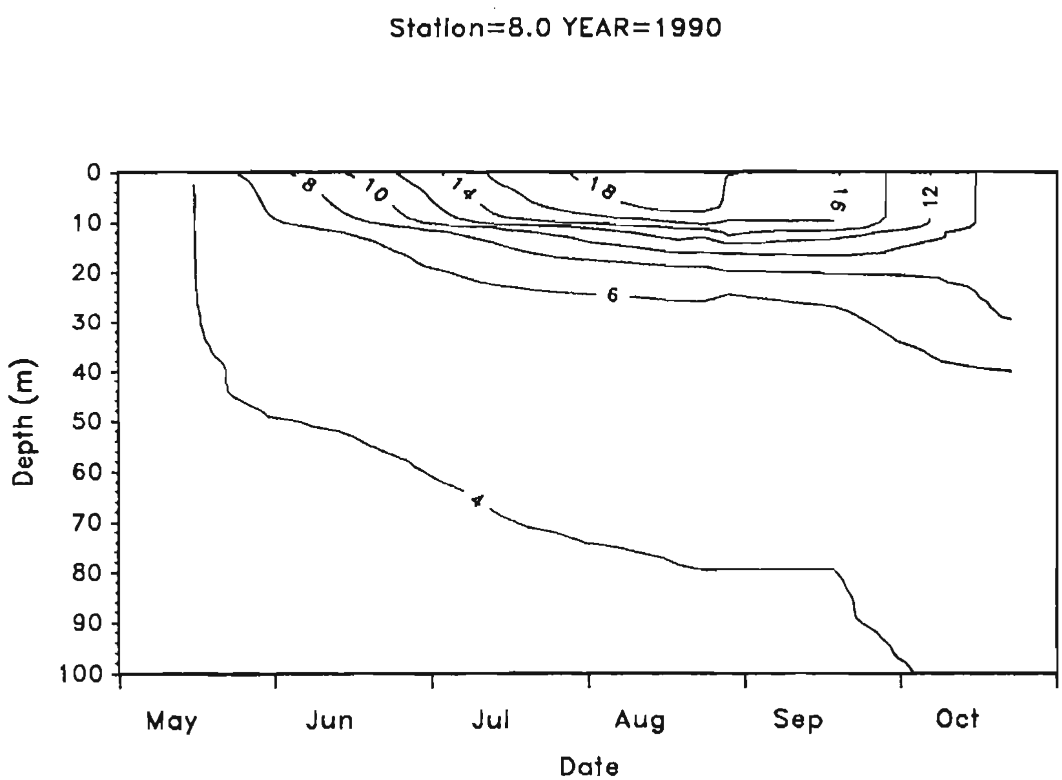
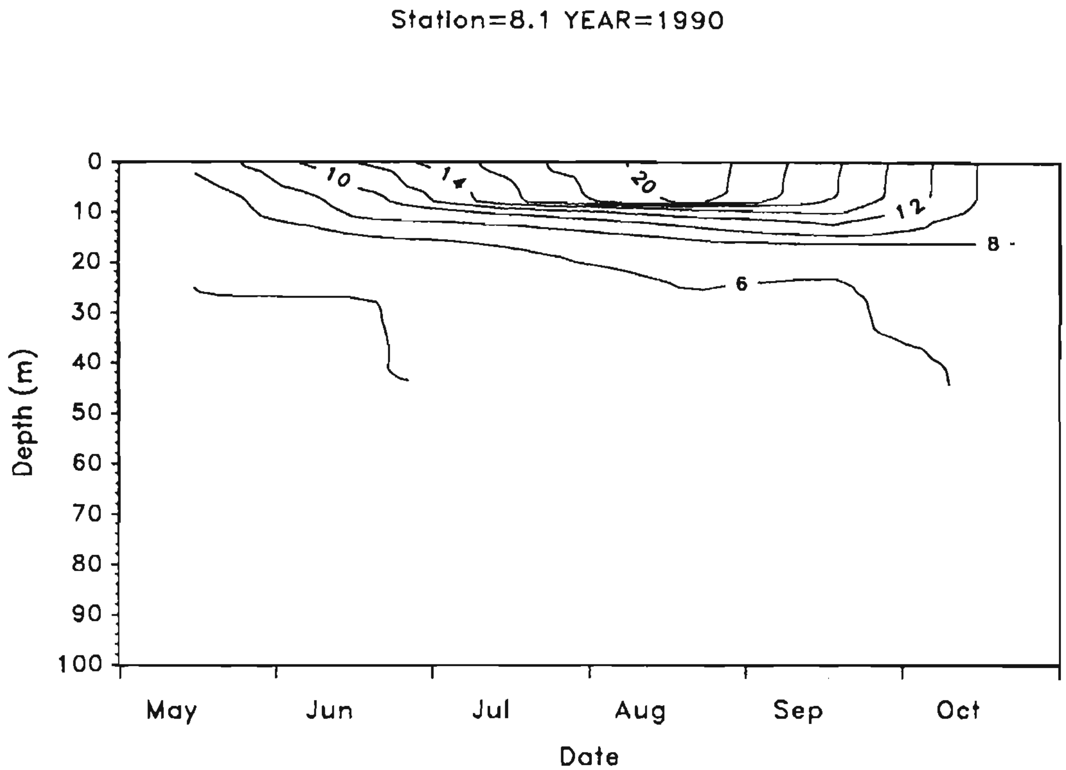


Fig 4. Seasonal variation in thermal structure.



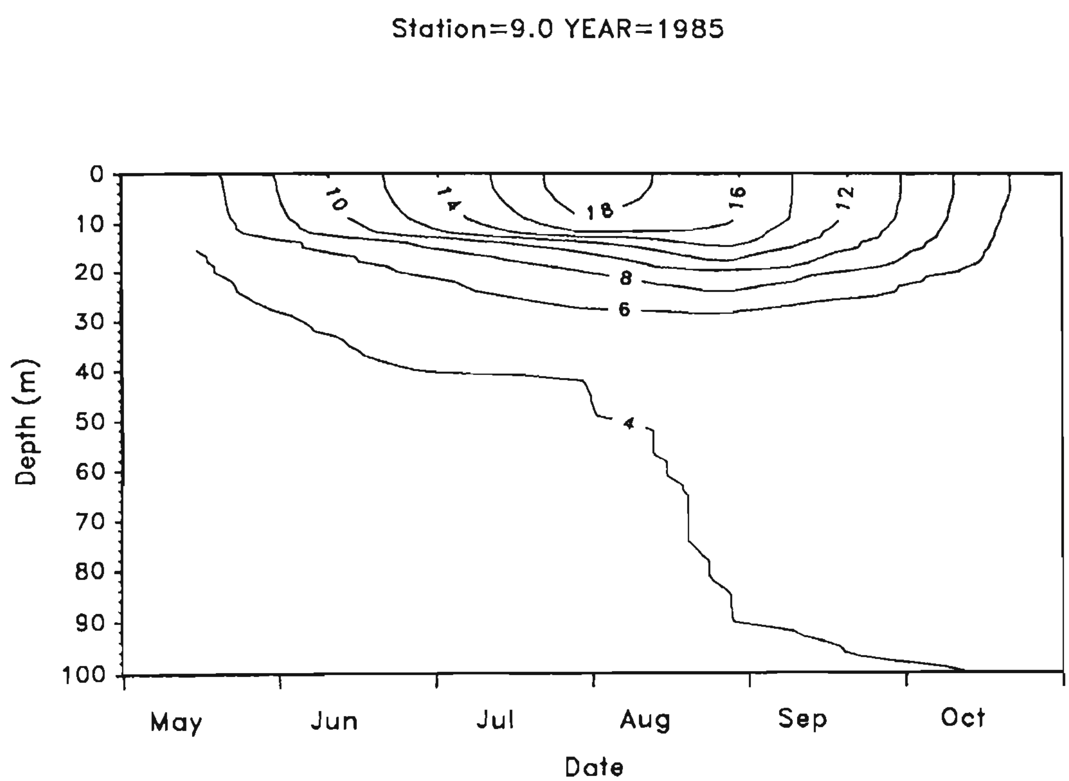


Fig 4. Seasonal variation in thermal structure.

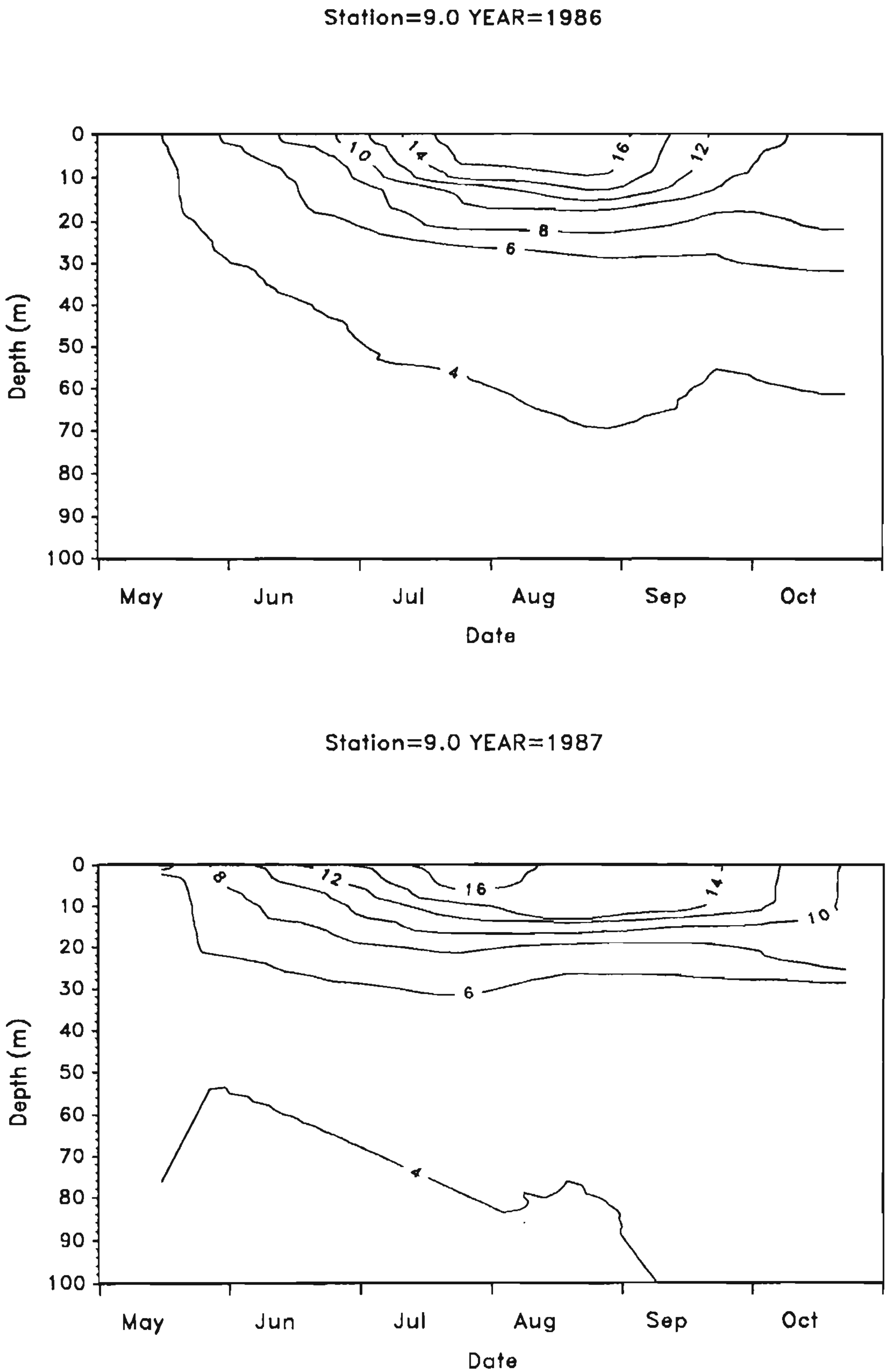
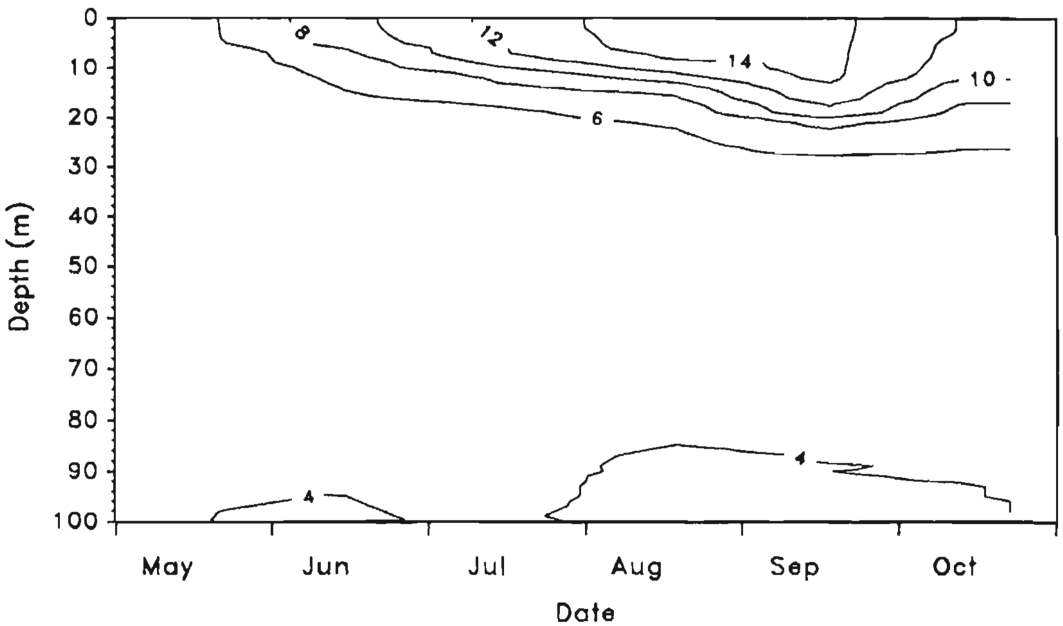


Fig 4. Seasonal variation in thermal structure.

Station=9.0 YEAR=1988



Station=9.0 YEAR=1990

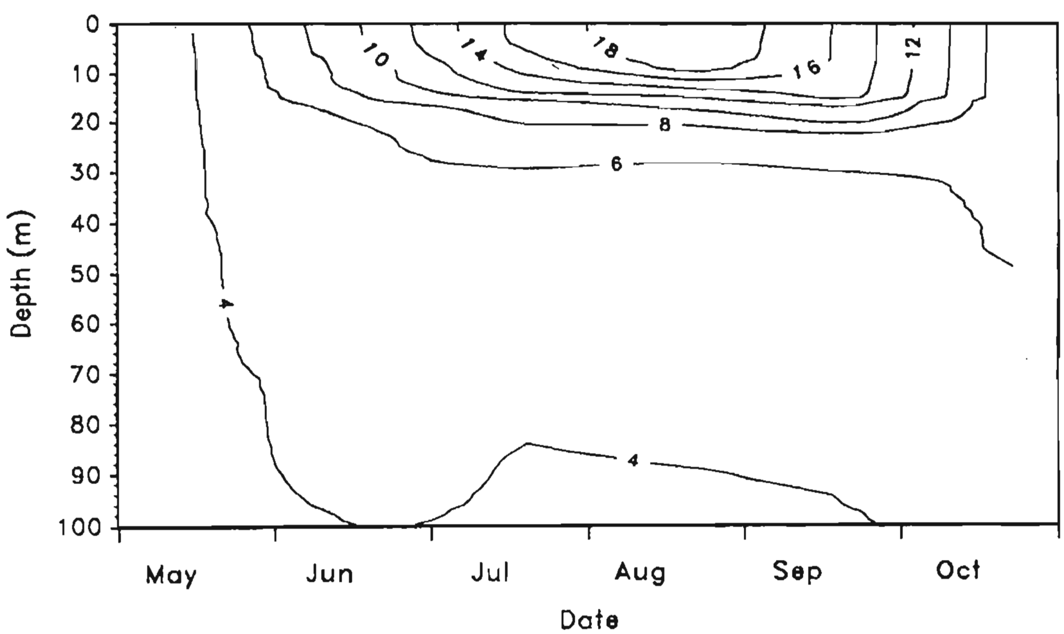


Fig 4. Seasonal variation in thermal structure.