



**The Catalogue of Oceanographic Data on  
Collaborative Survey on Oceanic Squid  
in the South China Sea**

**Phase II : Waters of Sabah, Sarawak and Brunei Darussalam**

15 March - 13 April 2000

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## **Preface**

The Collaborative Study on Resource and Fishing Ground Conditions of the Oceanic Squid has been carried out for phase II: Waters of Sabah, Sarawak and Brunei Darussalam during 15 March - 13 April 2000. The main objectives are to determine the squid fishing ground characteristics and to study on the relation between oceanographic parameter and the catch.

This report is profiles of the principle physical and chemical oceanographic data of the survey area that covers 21 oceanographic stations obtains from latitude 8° N to 7° N and longitude 109° 30'E to 115° 30'E.

For reader who may need this report or digital data, please make inquires to:

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## **Introduction**

The principle physical and chemical oceanographic data of 21 stations from off shore of Sabah, Sarawak and Brunei Darussalam from latitude 8° N to 7° N and longitude 109° 30'E to 115° 30'E during 15 March – 13 April 2000 were plotted as profiles and diagrams. The data were composed with temperature, salinity, dissolve oxygen, fluorescence, pH, total alkalinity, nitrate, nitrite and light transmission.

### **Integrated CTD Data Procedures**

There are two CTD instruments were used in this survey;

1. Falmouth Integrated CTD.
2. Sea-Bird Electronics, SEACAT SBE19 CTD.

Starting from station 8 to 13, The SBE19 CTD were used instead of the Falmouth Integrated CTD due to the main oceanographic winch was not working properly. Up to station 7 the oxygen sensor of Falmouth Integrated CTD was malfunctioned, the dissolved oxygen from station 8 to 21 were got from SBE19 CTD.

### **CTD Casting**

1. Before each cast, the submersible-sensing unit was acclimatized at sea surface for at least 1 minute.
2. Uninterrupted lowering speed was set at 1 m/s and the maximum depth for CTD casting during this cruise for Falmouth Integrated CTD was limited to 1500 m and for SBE19 CTD was limited to 600 m.
3. Lifting speeds were varied between 0.5 –1 m/s depending on the position of the submersible unit as well as the status of the hydraulic system of the vessel.
4. During lifting the Falmouth Integrated CTD, water samples were collected at the standard depths (1500, 1000, 500, 200, 150, 100, 75, 50, 30, 20 and sub-surface), fluorescence maximum, thermocline layer and other interesting layers observe on a real-time monitoring screen were also collected by the Niskin sampler rosette.

### **Data Acquisition System**

The Falmouth Integrated CTD with the following sensors:

<b>Property</b>	<b>Sensors</b>	<b>Specifications</b>
Temperature	Falmouth Scientific Platinum Resistance Thermometer (100 ms)	+/- 0.003 °C
Conductivity	Falmouth Scientific Inductive Conductivity Sensor	+/-0.003 mmhn
Pressure	Falmouth Scientific Titanium Pressure Sensor	+/- 0.03 %
Dissolved Oxygen	Beckman Polarographic Membrane Sensor	+/- 100 ppm
Fluorescence	Sea Tech Fluorometer	
pH	Innovative Teflon Junction pH Sensor	

**Remarks:**

1. The pH sensing system was not functioned properly during this cruise and the *in situ* continuous pH reading was ignored. Accumet model 1002 handheld pH/mV/Ion meter measured the pH data for each station.
2. Up to station 7, the oxygen sensor was not functioned properly. The calculation oxygen data was calculated from titration - dissolve oxygen, using an emprirical relationship.
3. The ICTD unit was last sent for calibration and dock testing at the manufacturer in April 1997

The submersible sensing unit was connected to the Falmouth Scientific DT-1050 data terminal on board via the Armord sea cable (SEA Corporation). The data was recorded as raw A/D count with the sampling frequency for each channel of 25 Hz.

**Post Acquisition Data Processing/Quality Control**

Raw data for each cast were searched for errors, especially the upcast dataset where signal interference from the rosette sampler firing occurred. Bad data were replaced by linear interpolation between the last good data before and the first good data after the bad data range.

In order to reduce data noise, raw data was average at every 1 dbar pressure interval. The pressure averaged data profile for each cast was visualized again and any remaining outliers were subsequently removed manually.

Unless specified otherwise, only downcast data will be reported but both of the downcast and upcast datasets were pressures averaged and archived.

**Data Conversion**

Raw counts for each variable were converted to the appropriate unit by polynomial regression equation embedded in the calibration file of each cast. The equation for each variable was:

Standard physical oceanographic properties

- Conductivity (in mmho/cm) =  $0.0001 \times \text{counts}$
- Temperature (in Celsius) =  $0.000500119 \times \text{counts}$  (ITS-90 standard)
- Pressure (in dbar) =  $0.1 \times \text{counts}$
- Salinity (PSS78) was calculated from conductivity, temperature and pressure (Fofonoff and Millard, 1978)
- Potential density anomaly (sigma theta in  $\text{kg/m}^3$ ) was obtained from the equation of state of seawater using potential temperature corrected to 0 dbar pressure
- Depth (in m) was obtained by dividing dynamic height by gravity acceleration
- Fluorescence (in V) =  $0.00732 \times \text{counts}$
- Dissolved oxygen (in ml/l) =  $C \cdot \text{counts}^2 + D \cdot \text{count} + E$

where C, D and E were obtained from binomial regression between the observed saturation state (the ratio between titration oxygen content of water sample and oxygen saturation according to Weiss, (1970) at that depth and the raw count for oxygen current channel (Owens and Millard, 1985) for that cast. Sensor response time was assumed to be instantaneous, and the temperature and pressure corrections for membrane were ignored.

The SEACAT SBE19 CTD with the following sensors:

<b>Property</b>	<b>Sensors</b>
Temperature	Sea-Bird Temperature Sensors
Conductivity	Sea-Bird Conductivity Sensors
Pressure	Paine Corporation, Strain Gauge Pressure Sensors
Dissolved Oxygen	Beckman Polarographic Membrane Sensor YSI5739 Series
Fluorescence	Wetlabs Wetstar Fluorometer
Light Transmission	Biospherical QSP-200PD par light sensor
Mini submersible pump	Sea-Bird 5M pump module

The SEASOFT software was supplied with the SBE 19. The SEACAT SBE 19 CTD instrument store and transmit “raw” data from their primary and auxiliary sensors in the form of binary number. The configuration file is create or modified by using the SEACON program and used by SEASAVE and DATCNV program to convert raw data to engineering units of the parameters being measured (temperature, conductivity, pressure, salinity, dissolved oxygen, etc.)

### **References**

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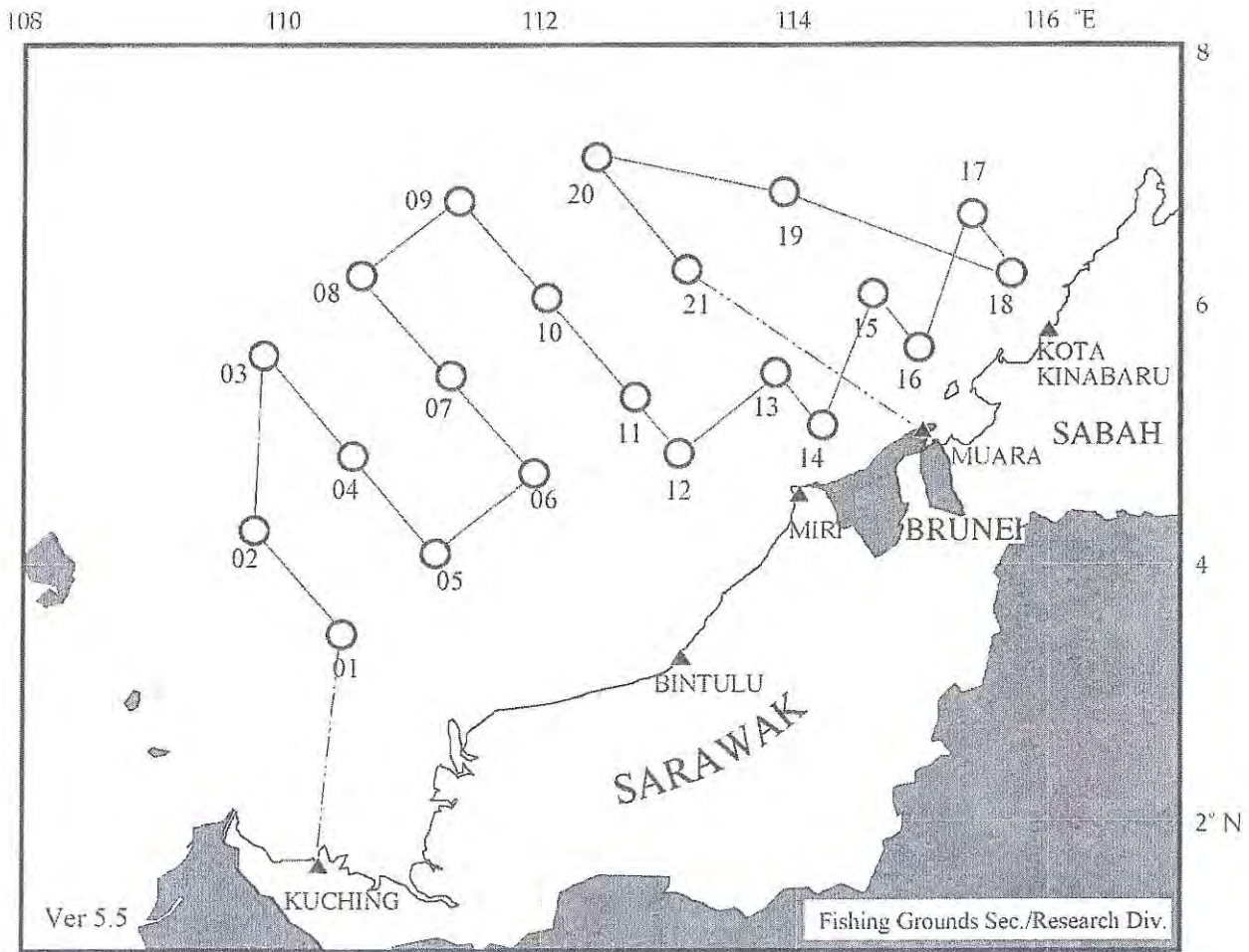


Fig.1 Survey area and sampling station of SEAFDEC Collaborative Research Survey on Oceanic Squid Phase II; Waters of Sabah, Sarawak and Brunei Darussalam during 15 March - 13 April 2000.

*The catalogue of Oceanographic Data; Collaborative Survey on Oceanic Squid in SCS,  
Phase II : Waters of Sabah, Sarawak and Brunei Darussalam*

Table 1. Partial details of sampling stations.

Station No.	Date	Local Time	GMT Time	Position		Sounding Depth(m)	Thermocline depth(m)	Thermocline temp(°c)	Equipment	
				Latitude	Longitude				CTD	Mini_CTD
1	20-Mar-00	06:34	00:34	03_44.18 N	110_42.45 E	65	11.50	28.11	X	
2	20-Mar-00	11:56	05:56	04_13.12 N	109_76.98 E	100	14.50	27.75	X	
3	20-Mar-00	19:04	13:04	05_56.72 N	109_86.80 E	145	10.50	26.34	X	
4	21-Mar-00	07:05	01:05	04_81.08 N	110_51.20 E	117	6.50	28.14	X	
5	21-Mar-00	16:11	10:11	04_02.58 N	111_17.90 E	71	9.50	28.98	X	
6	22-Mar-00	07:14	01:14	04_69.53 N	111_93.60 E	88	17.50	28.75	X	
7	22-Mar-00	17:08	11:08	05_45.27 N	111_29.45 E	452	-	-	X	
8	23-Mar-00	17:50	11:50	06_21.73 N	110_63.33 E	1,237	-	-		X
9	24-Mar-00	18:45	12:45	06_85.02 N	111_37.63 E	1,880	-	-		X
10	25-Mar-00	07:21	01:21	06_02.77 N	112_02.12 E	1,560	18.73	27.55		X
11	25-Mar-00	21:20	15:20	05_25.17 N	113_01.25 E	1,257	24.62	27.32		X
12	26-Mar-00	07:00	01:00	05_07.95 N	113_04.12 E	130	16.50	28.07	X	X
13	26-Mar-00	17:05	11:05	05_62.65 N	113_78.57 E	2,150	22.56	27.90	X	X
14	27-Mar-00	07:35	01:35	05_26.60 N	114_17.07 E	150	27.50	26.52	X	X
15	27-Mar-00	17:58	11:58	06_16.94 N	114_32.80 E	1,975	19.50	28.38	X	X
16	28-Mar-00	07:15	01:15	05_56.20 N	114_52.00 E	177	10.50	28.69	X	X
17	28-Mar-00	16:20	10:20	06_56.51 N	115_17.87 E	1,516	26.50	27.97	X	X
18	29-Mar-00	07:00	01:00	06_49.45 N	115_42.27 E	228	27.50	28.22	X	X
19	29-Mar-00	19:15	13:15	07_03.25 N	113_52.17 E	1,836	23.50	27.87	X	X
20	31-Mar-00	06:35	00:35	07_06.74 N	112_24.15 E	2,003	30.50	27.95	X	X
21	01-Apr-00	08:25	02:25	06_19.83 N	113_06.10 E	1,592	16.50	28.50	X	X



**Oceanographic and Laboratory Personnel on board the M.V. SEAFDEC**

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Boonsom Prangtip

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Nakaret Yasook  
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**Nutrient analysis**

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**Oxygen determination**

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Nathacha Sornvaree  
Sukchai Arnupapboon  
Nakaret Yasook  
Narumon Thapthim

**CTD and Water sampler control**

Natinee Sukramongkol

**Mini-CTD control**

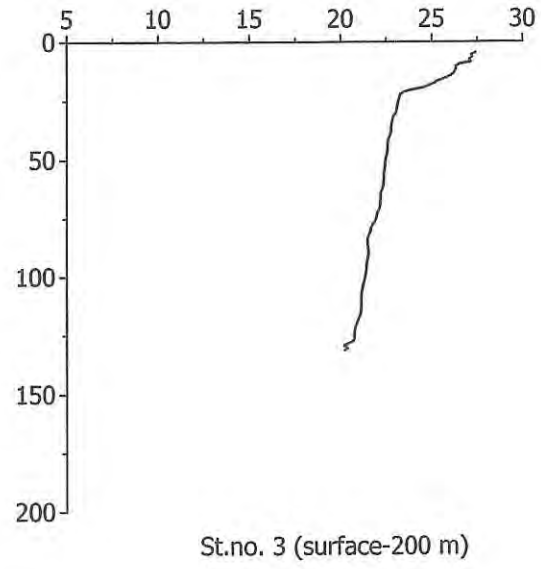
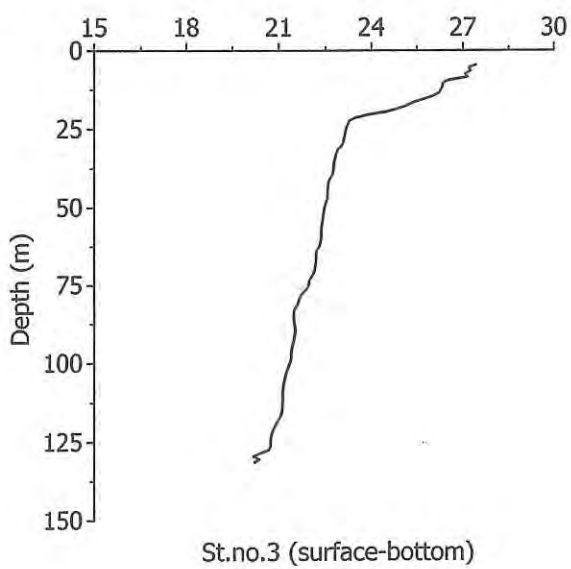
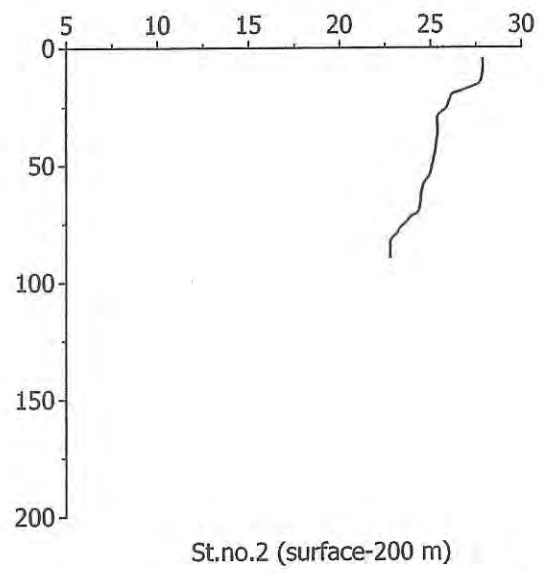
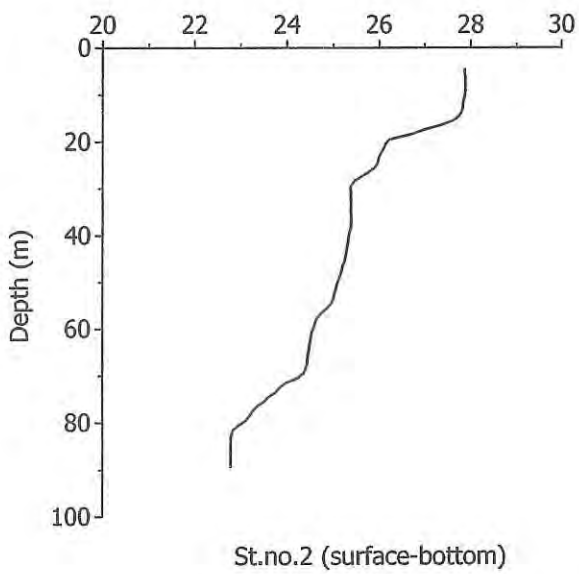
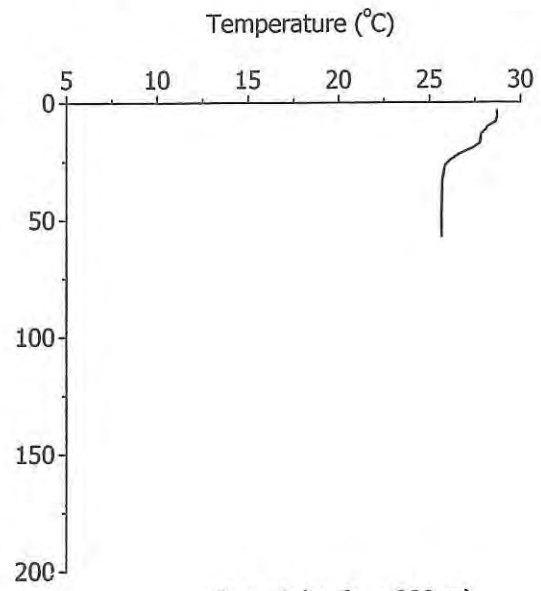
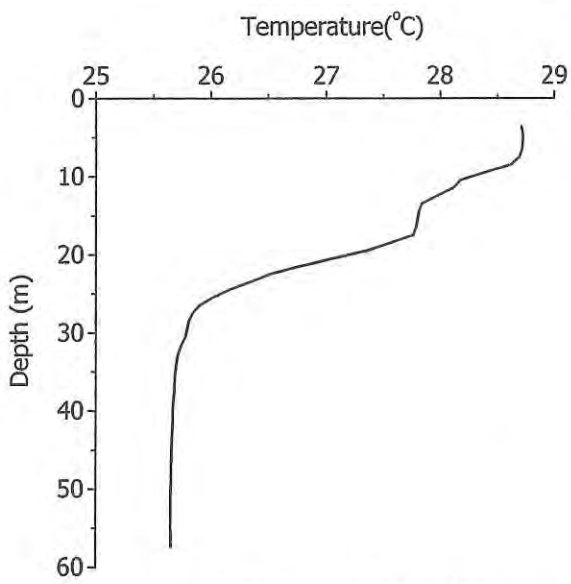
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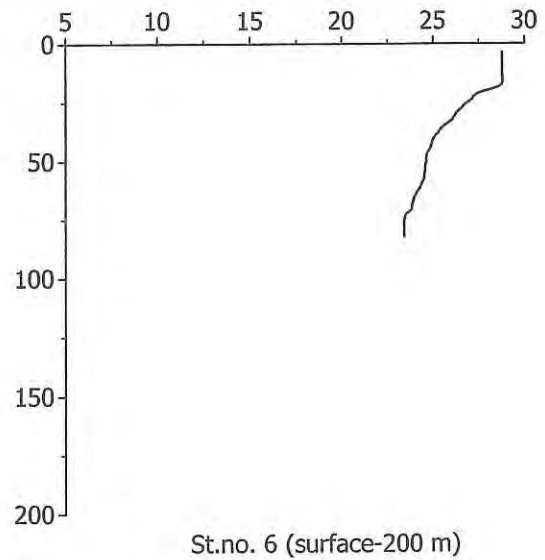
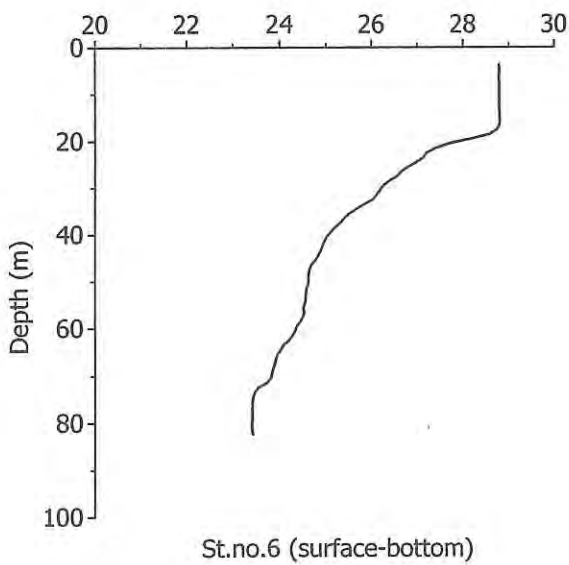
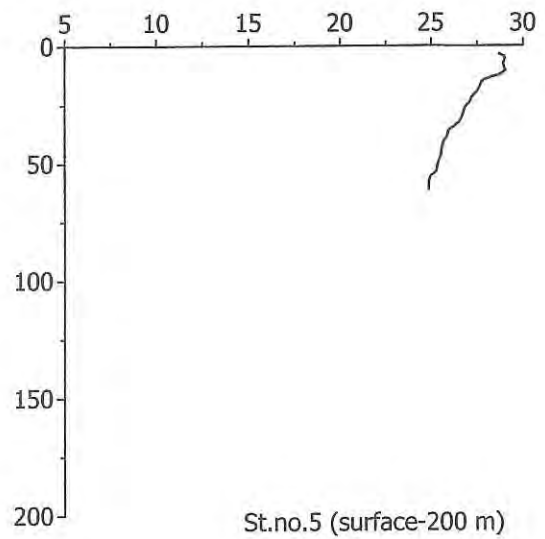
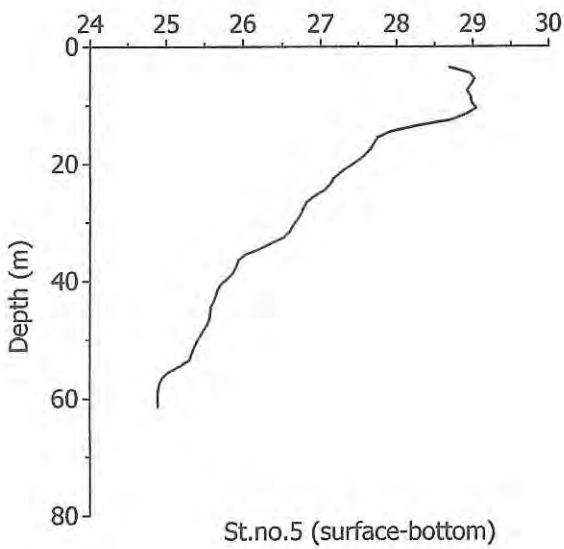
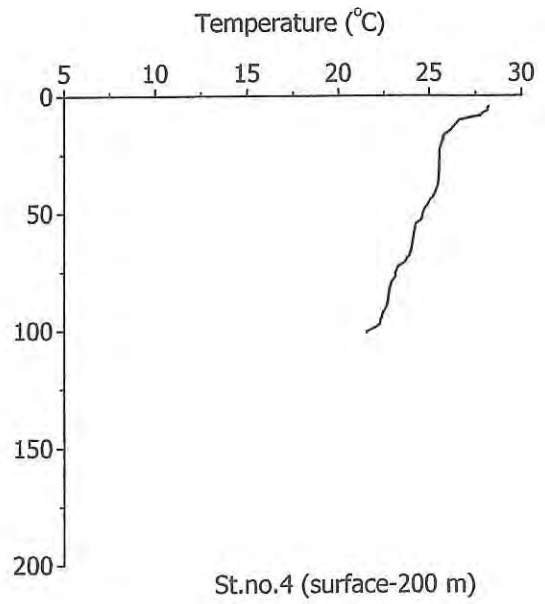
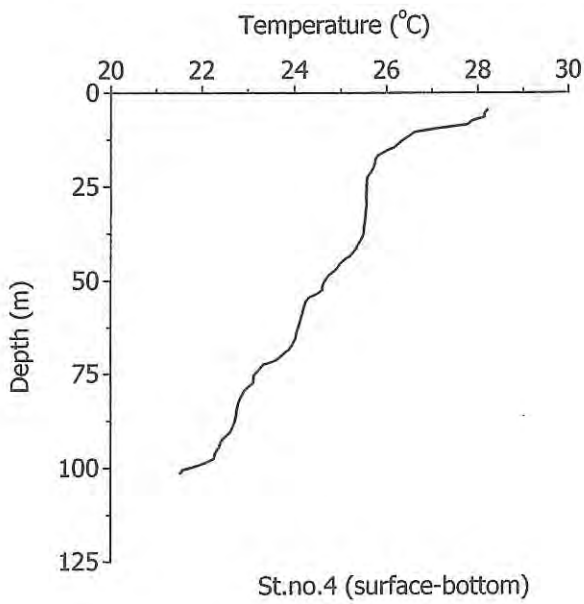
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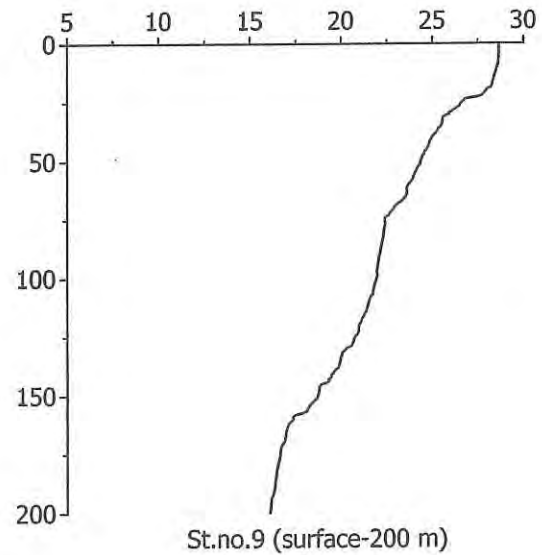
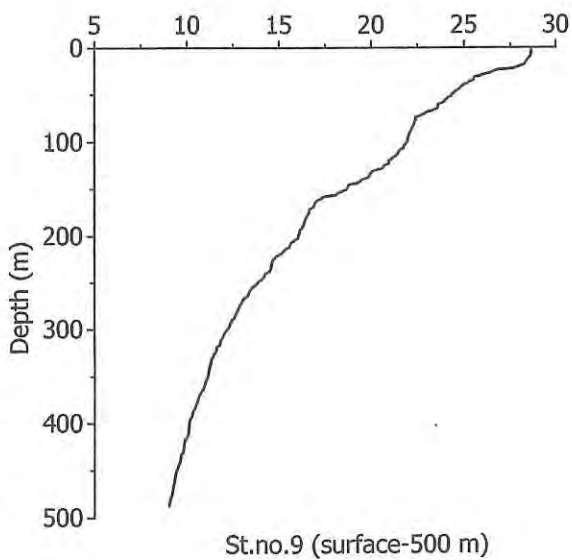
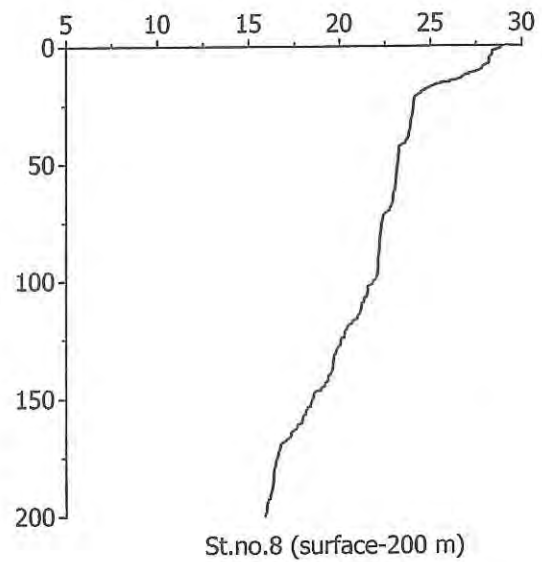
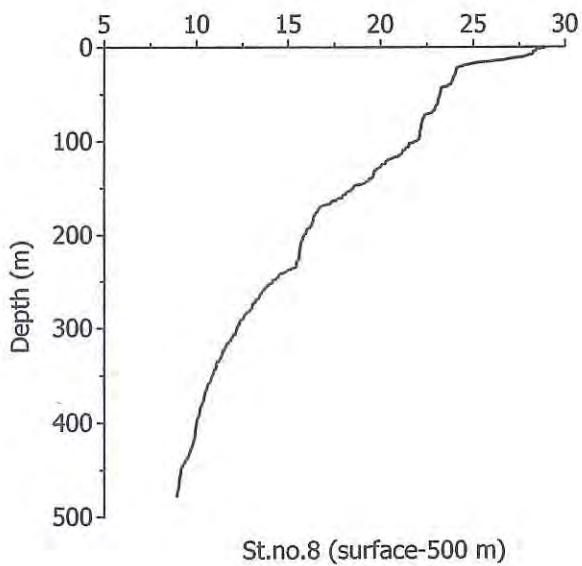
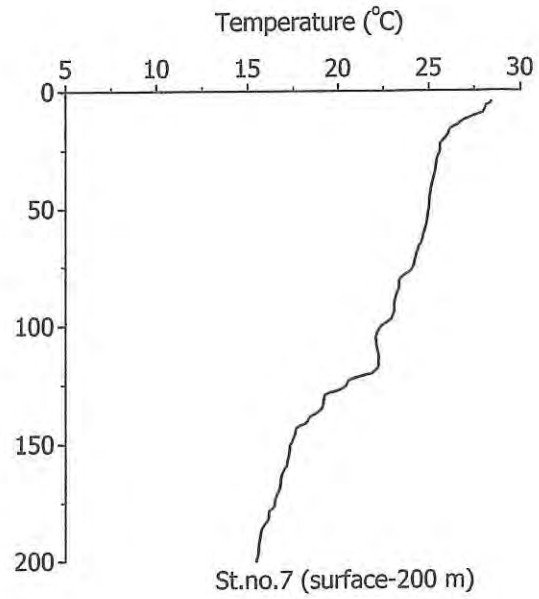
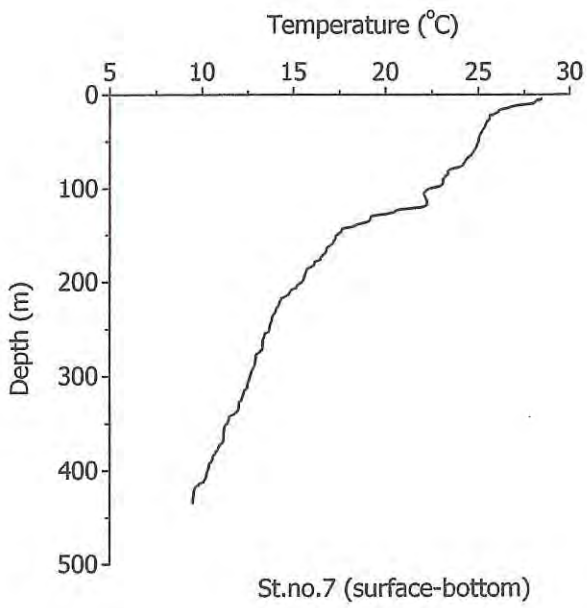
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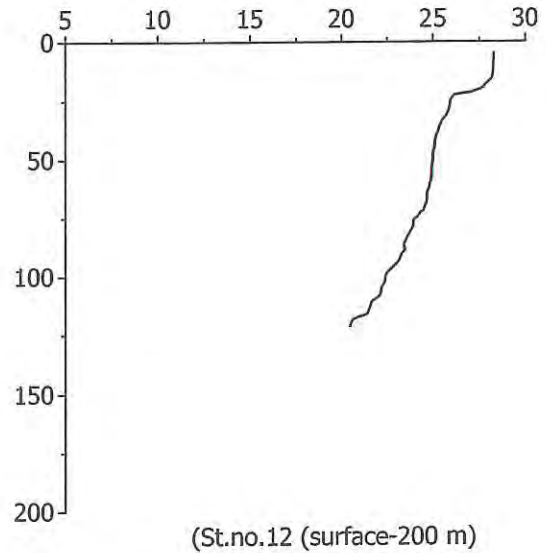
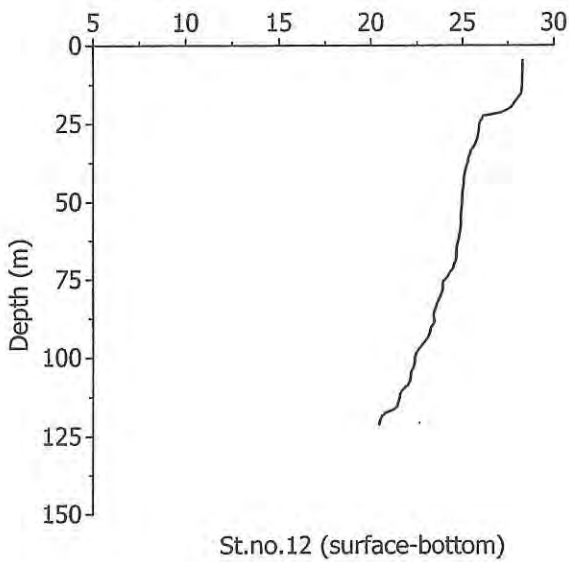
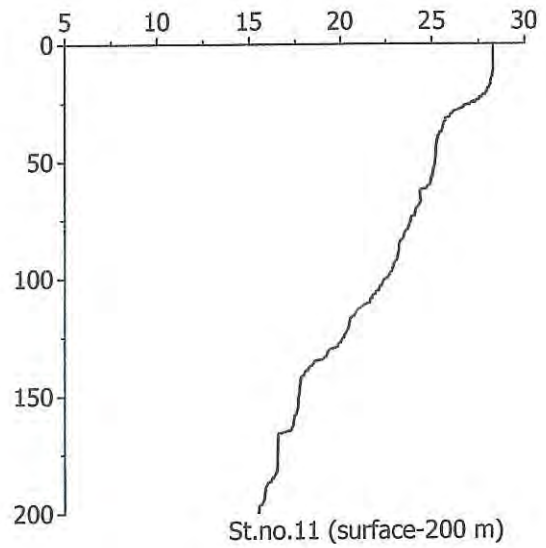
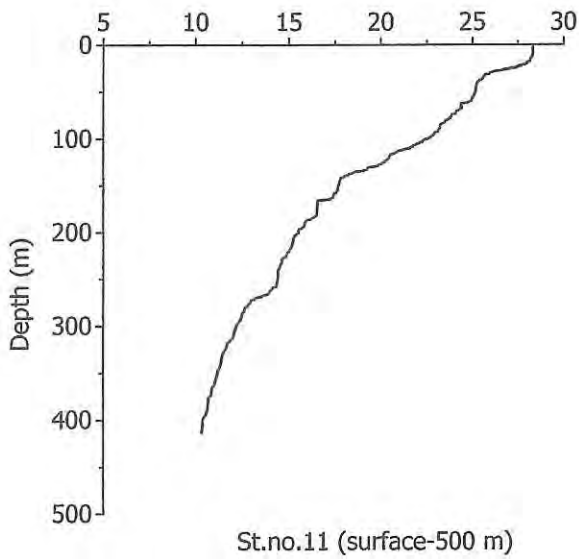
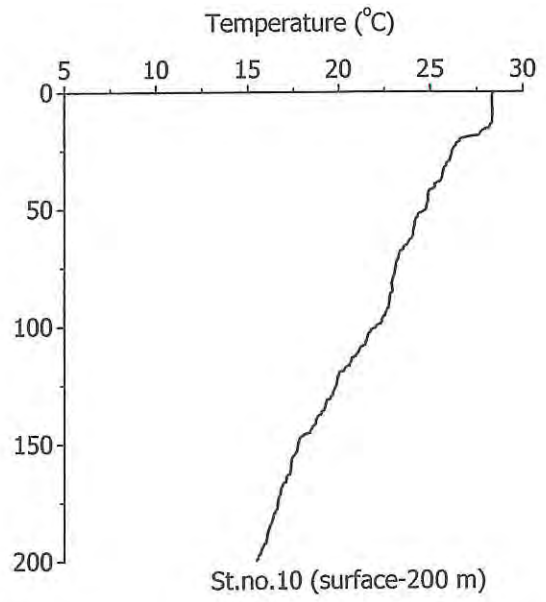
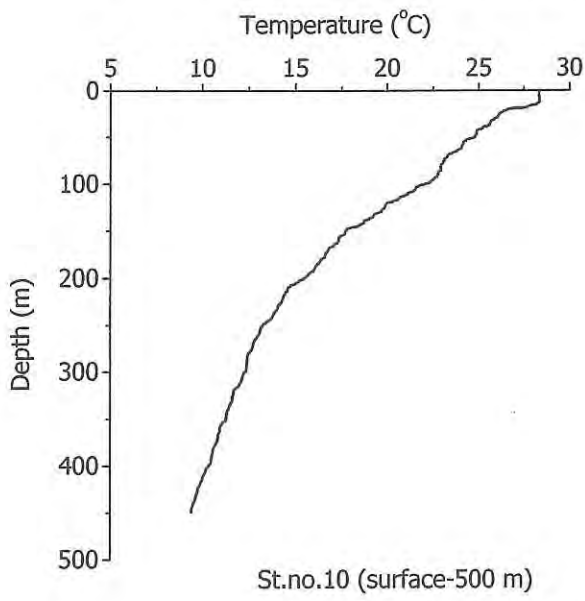
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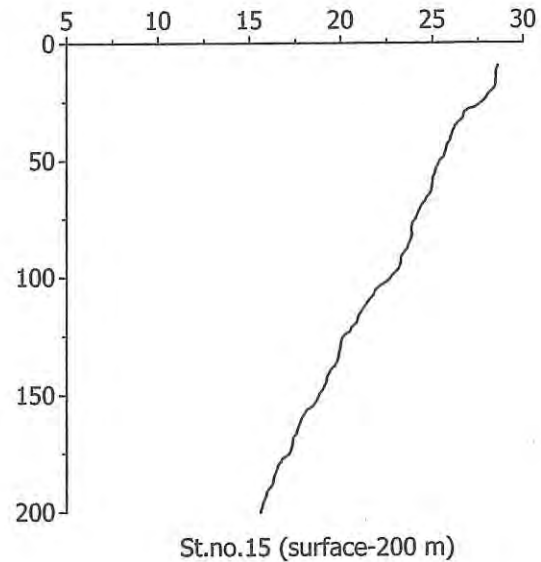
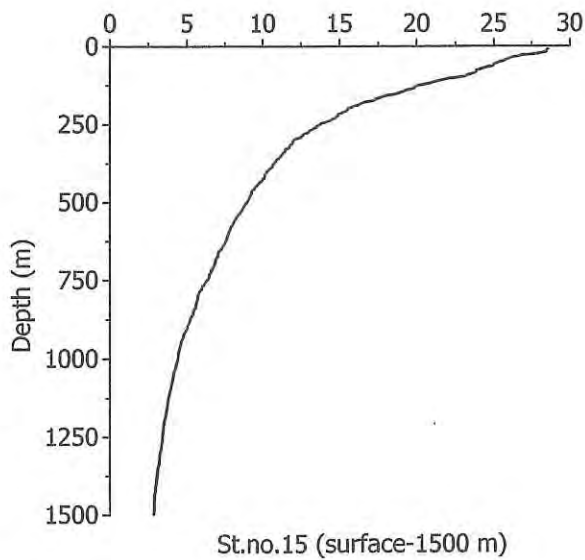
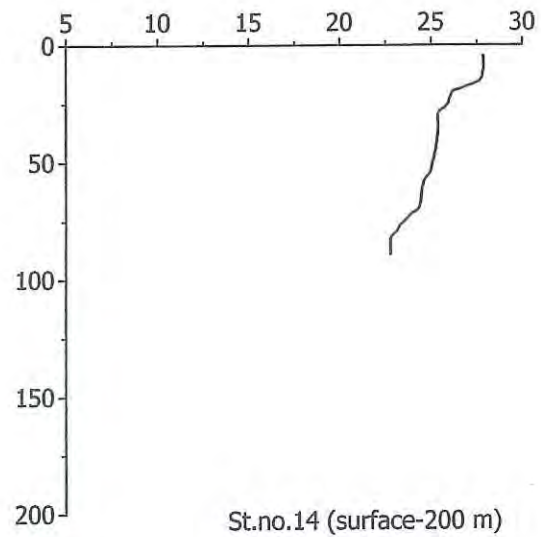
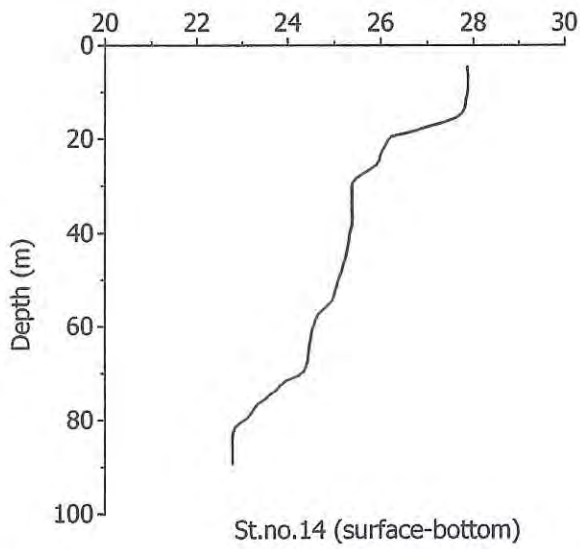
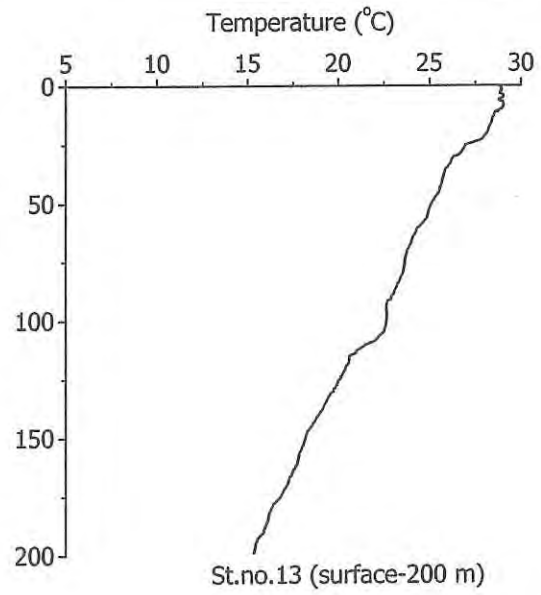
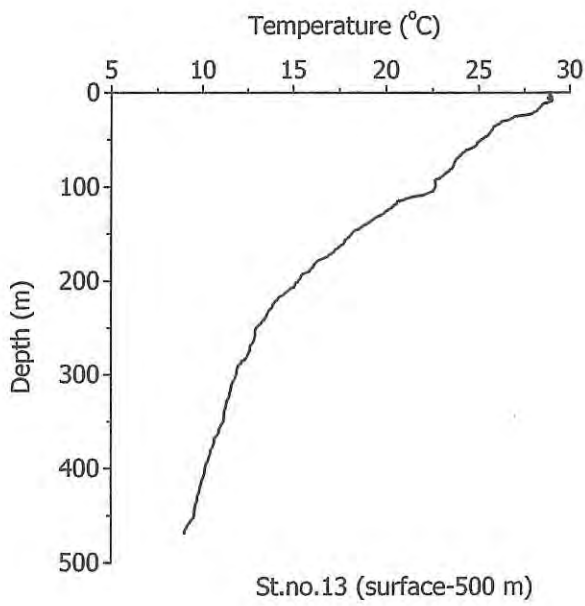
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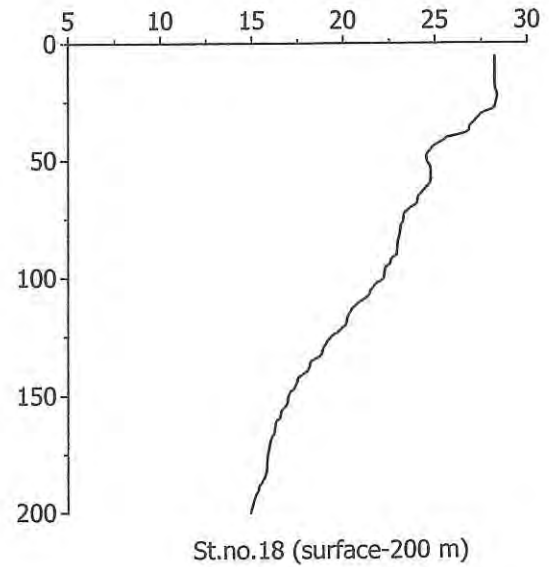
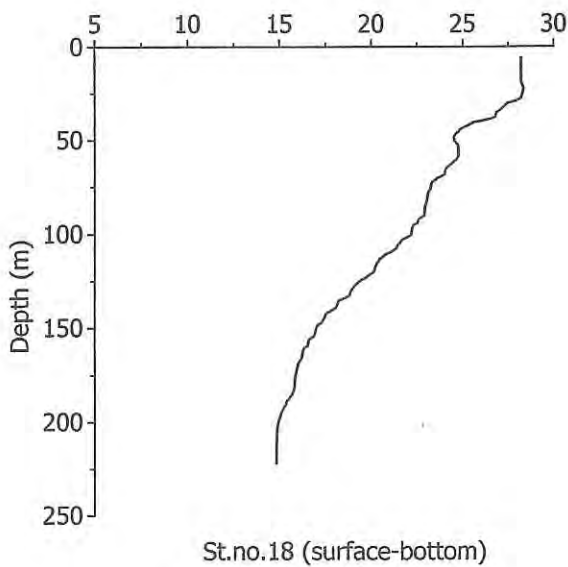
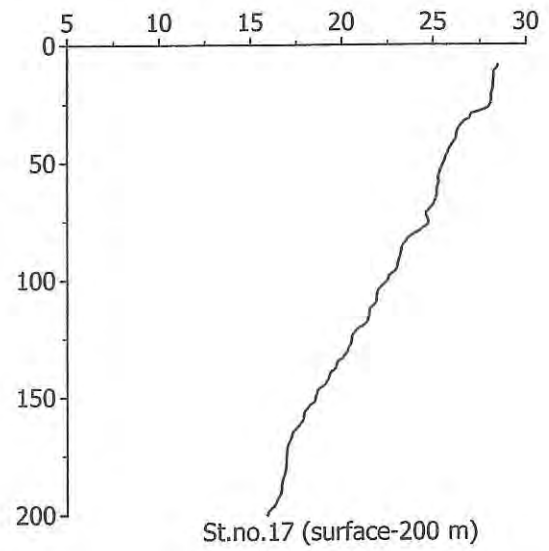
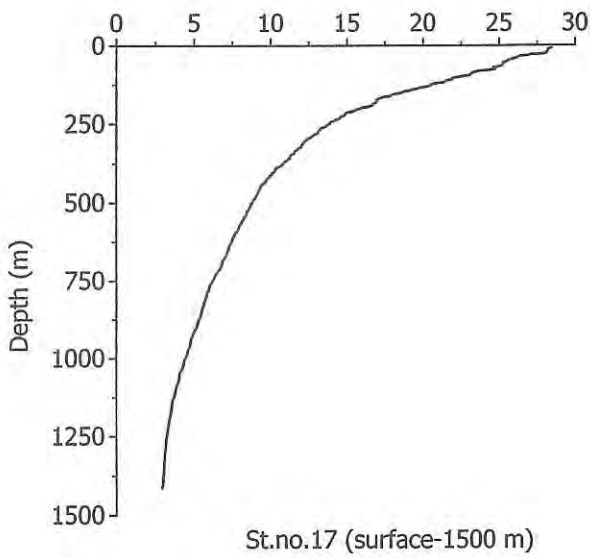
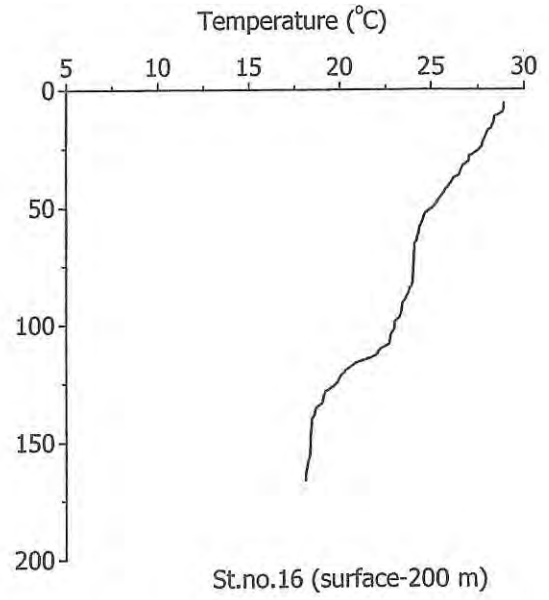
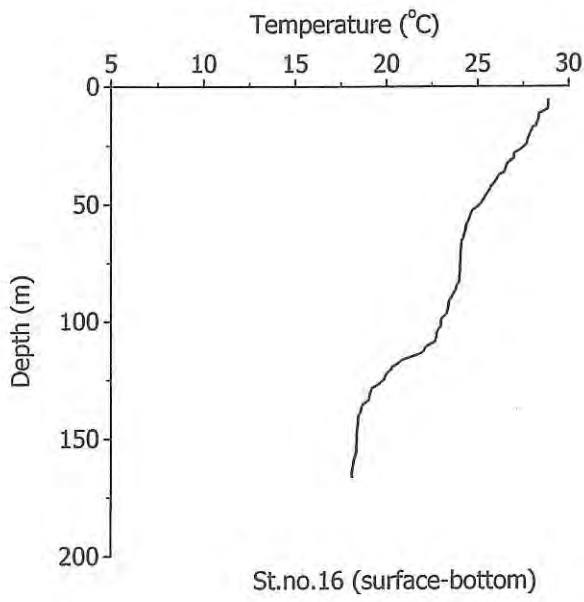


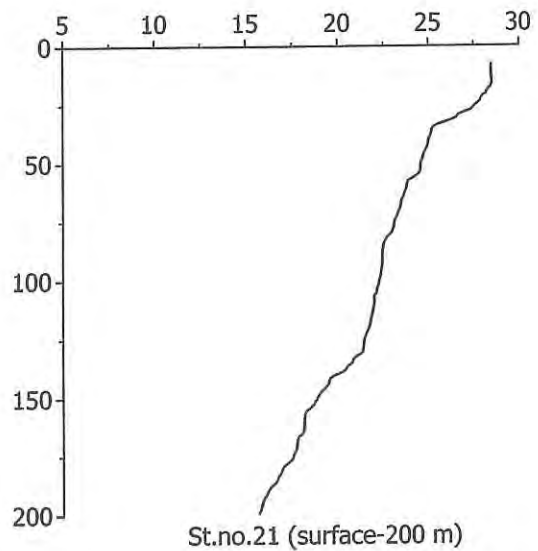
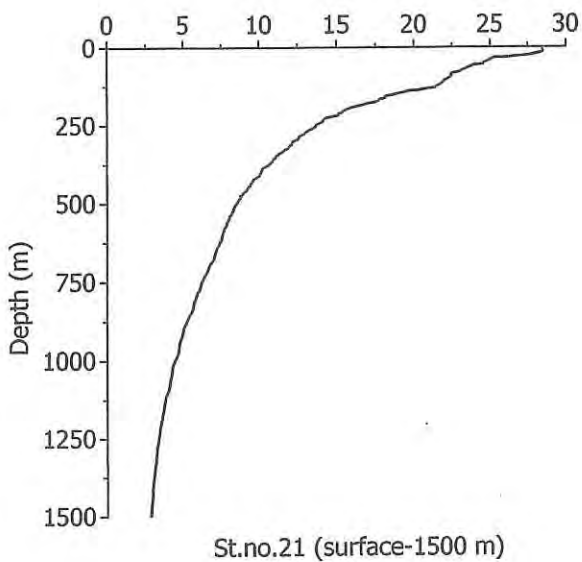
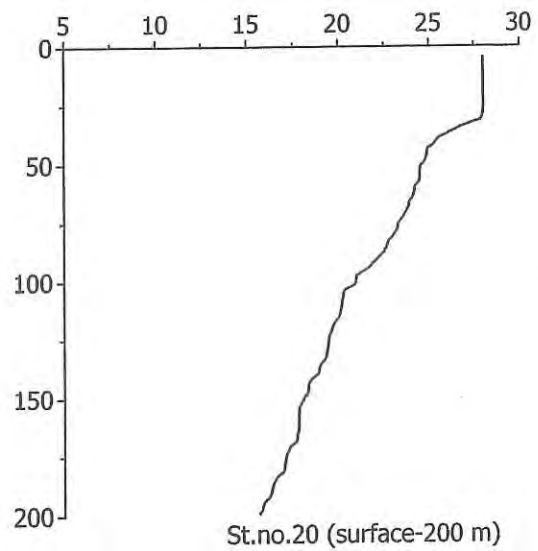
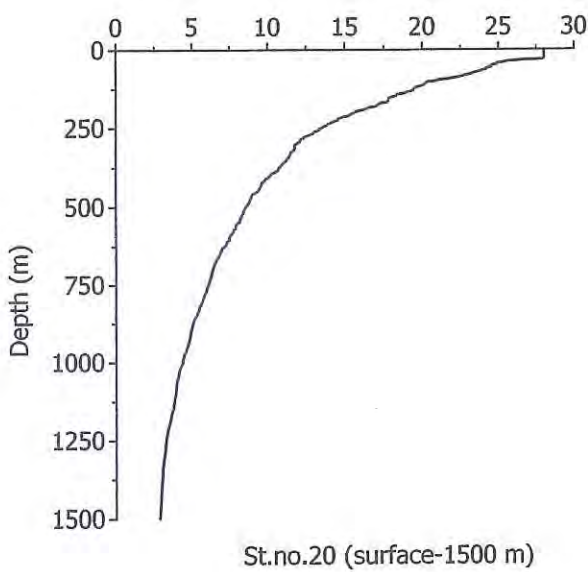
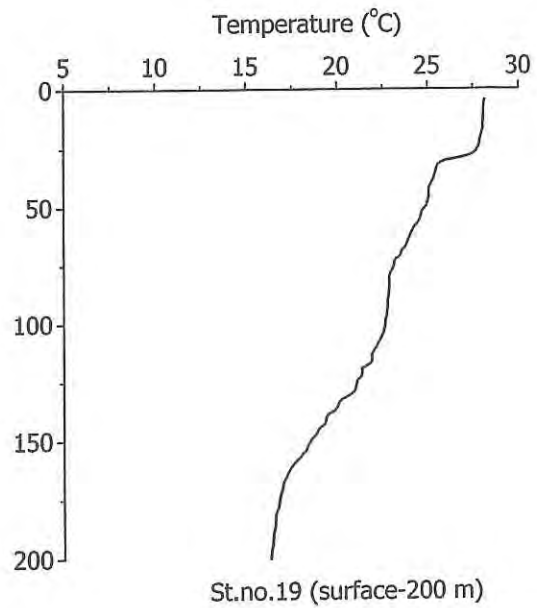
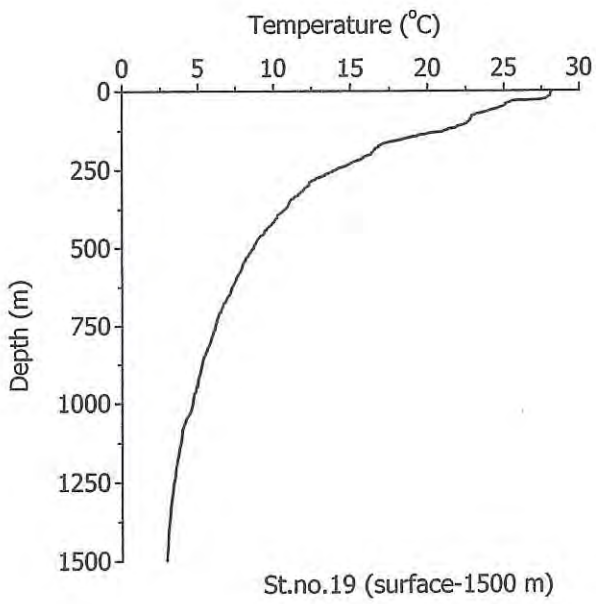


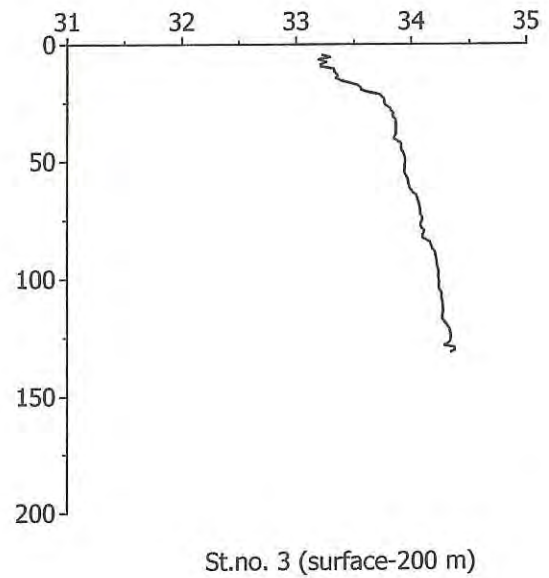
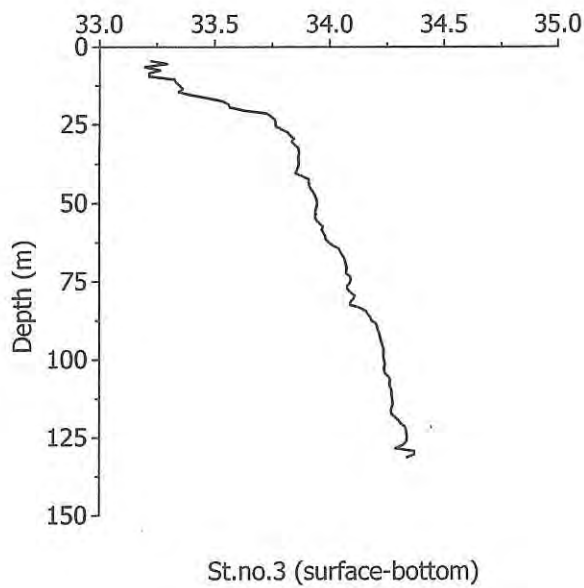
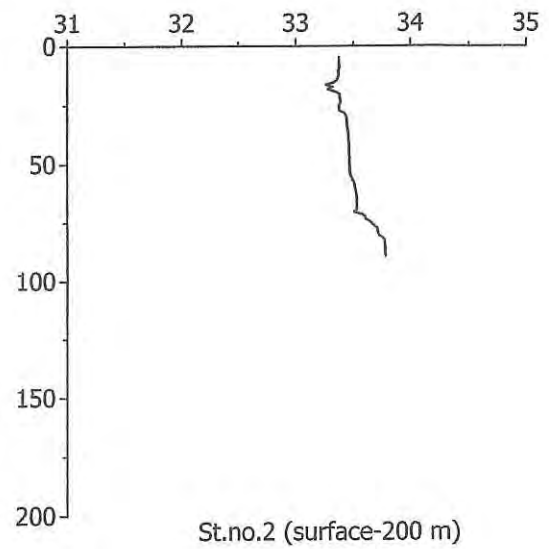
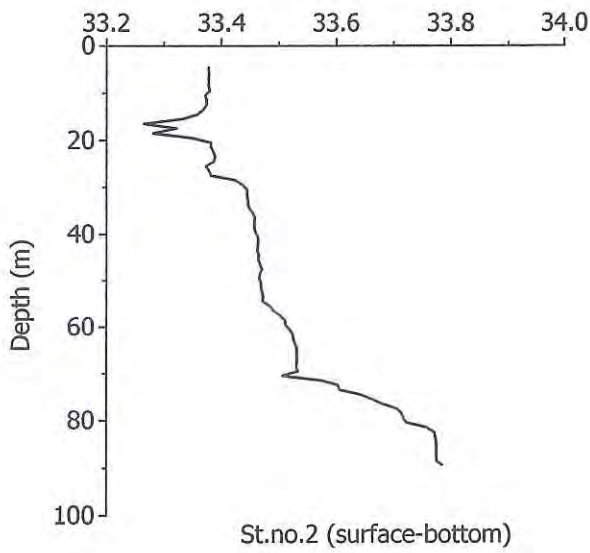
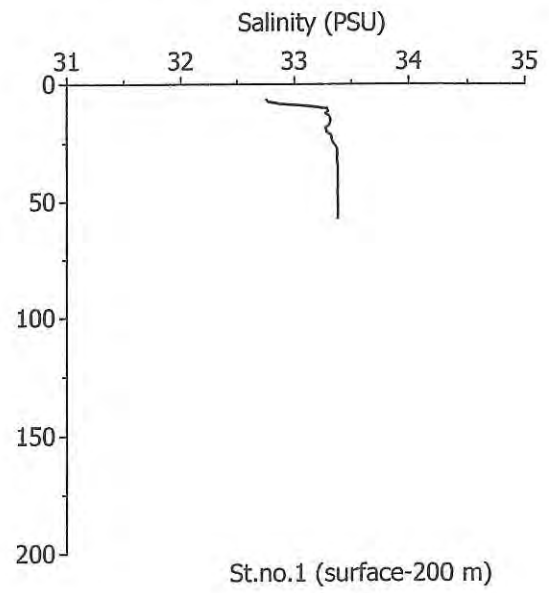
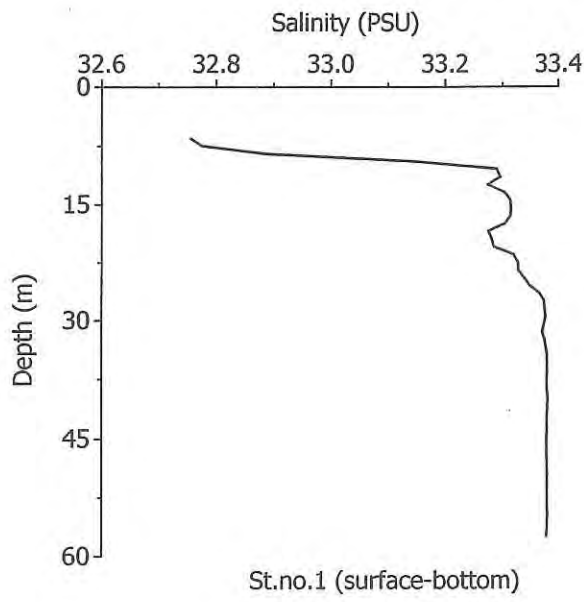


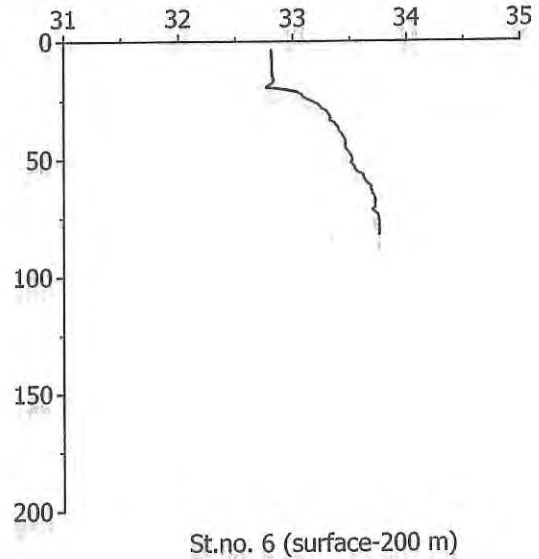
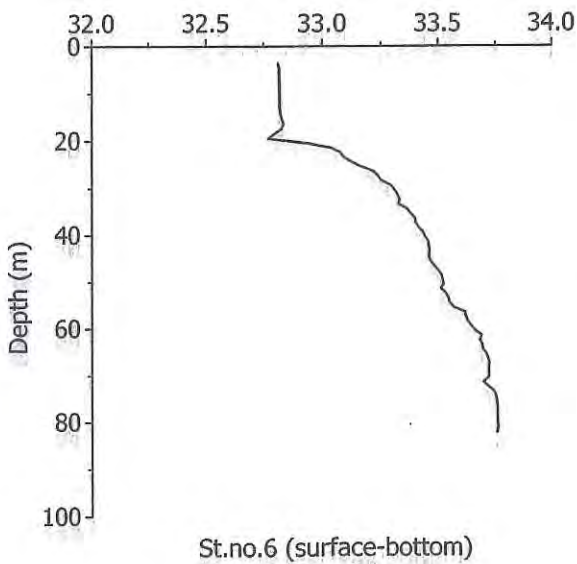
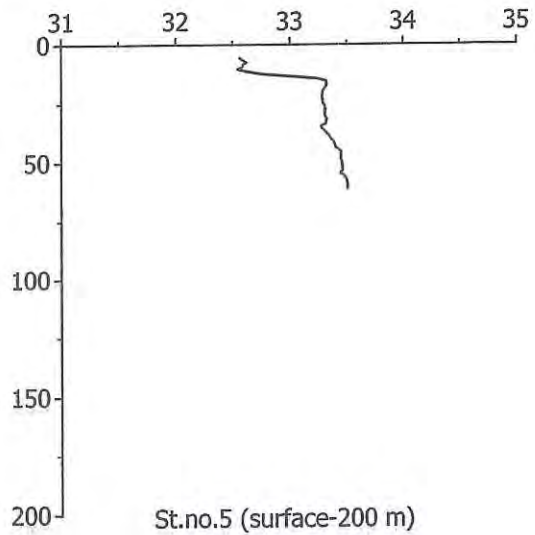
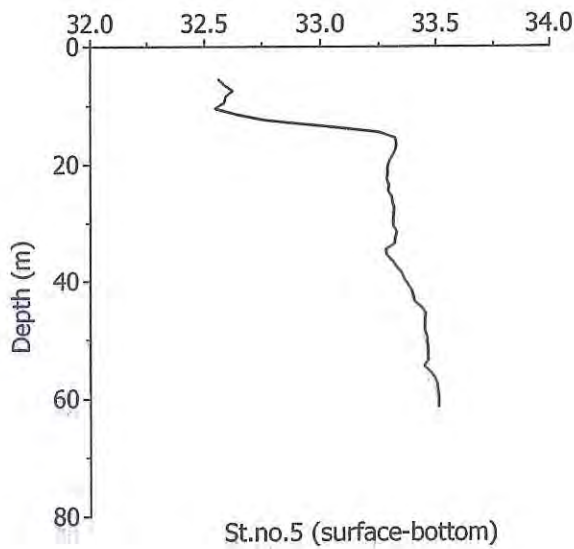
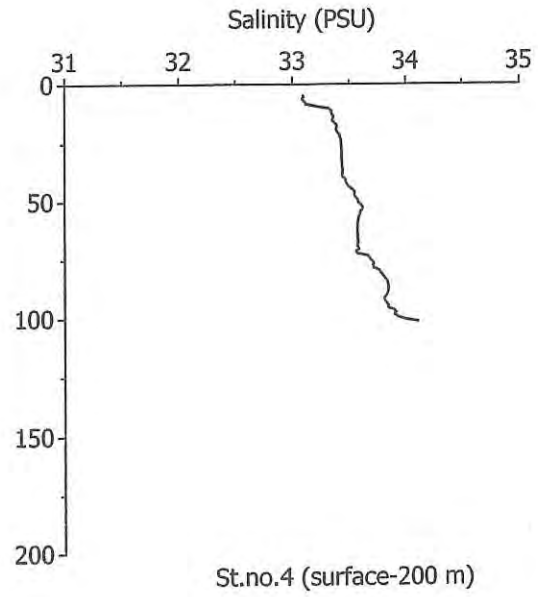
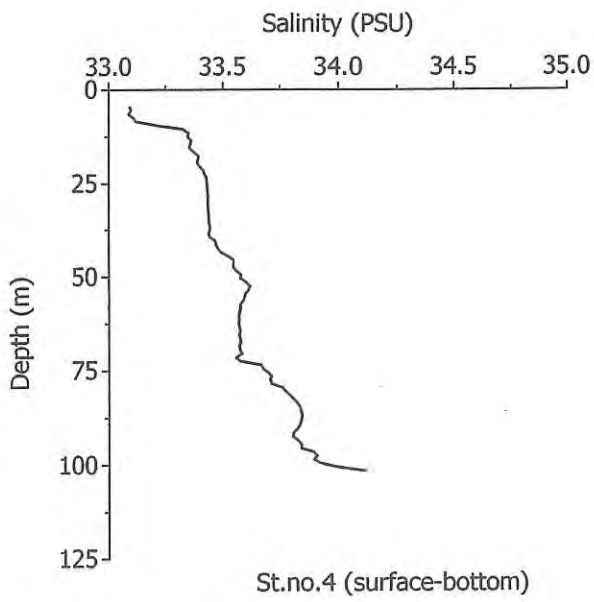


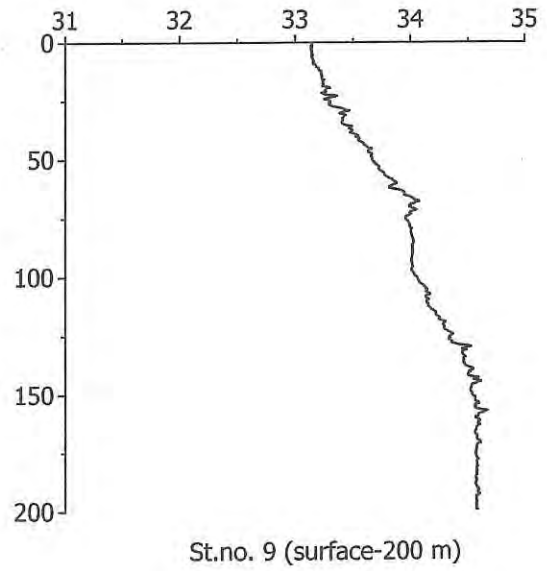
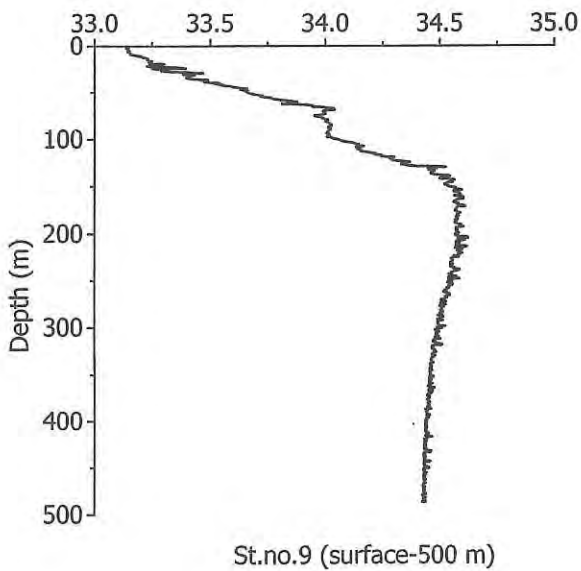
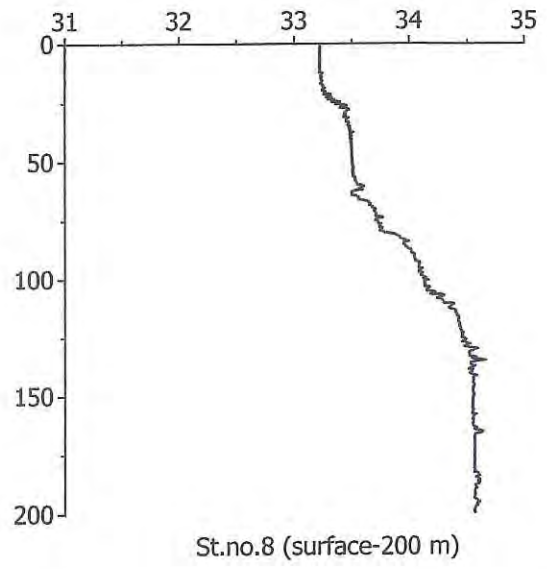
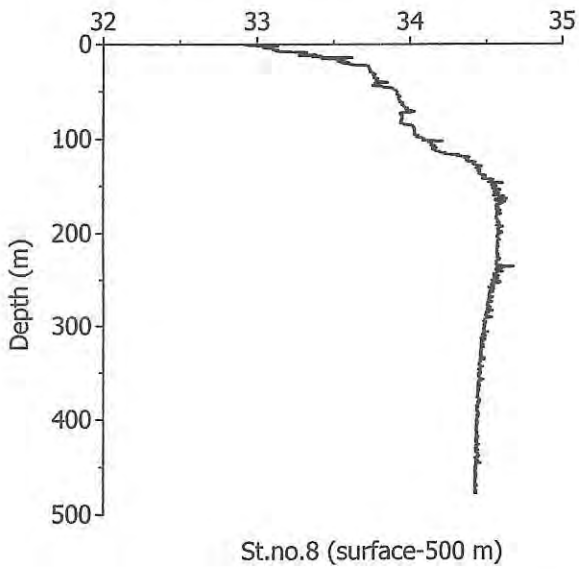
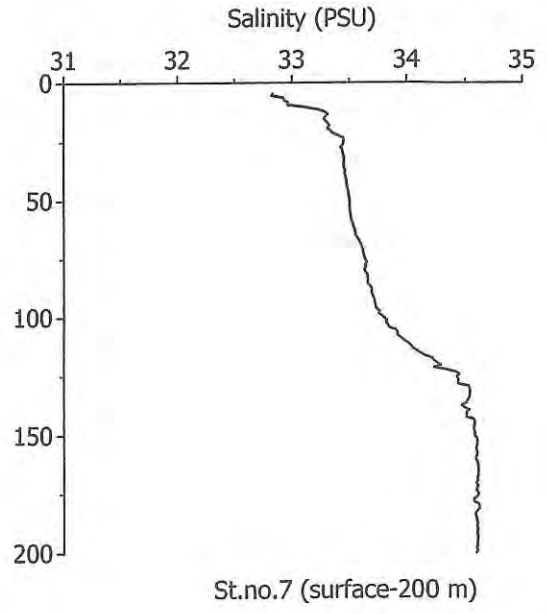
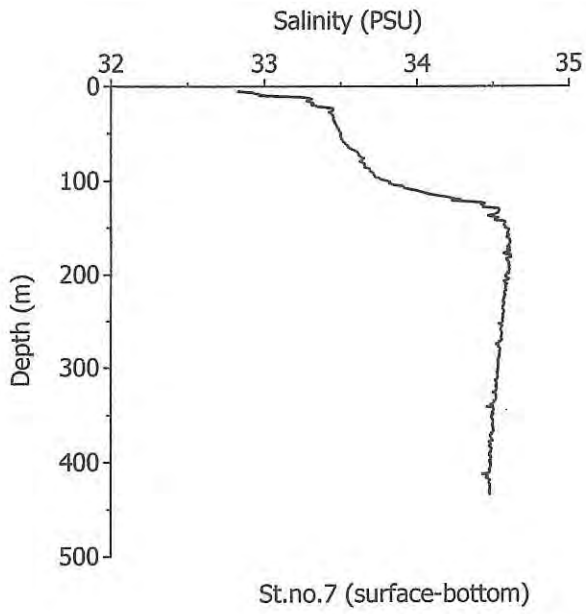


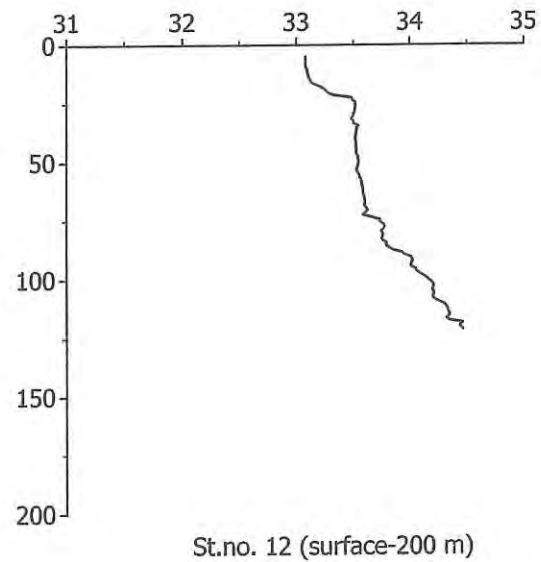
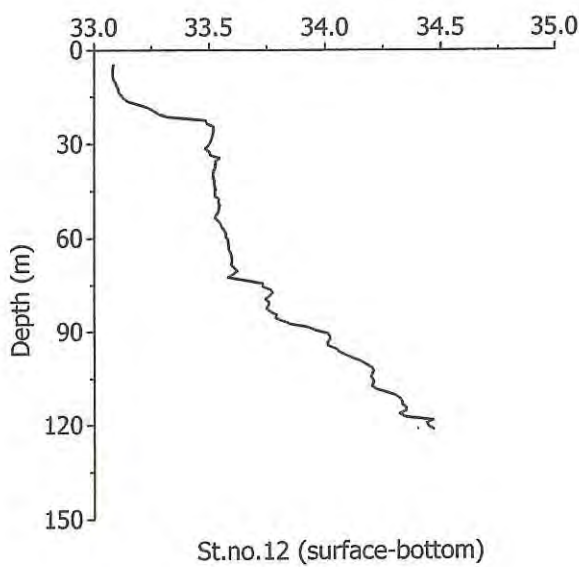
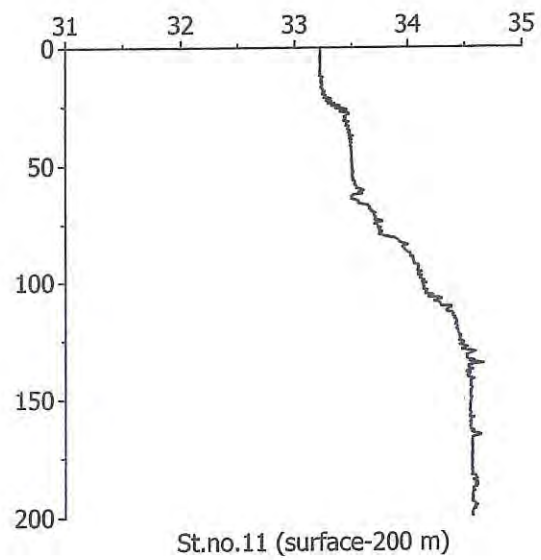
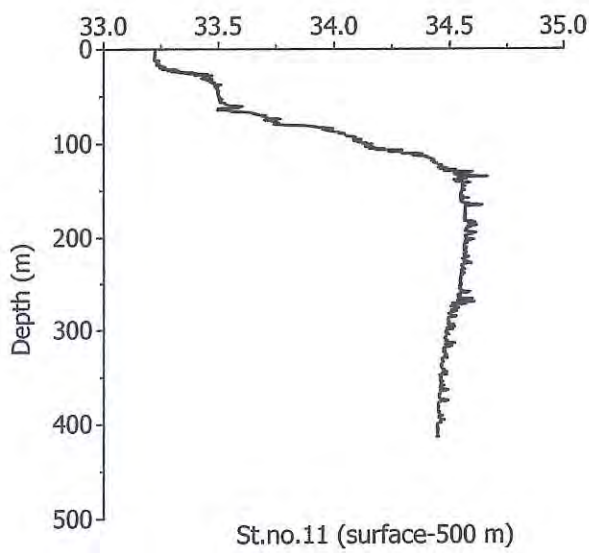
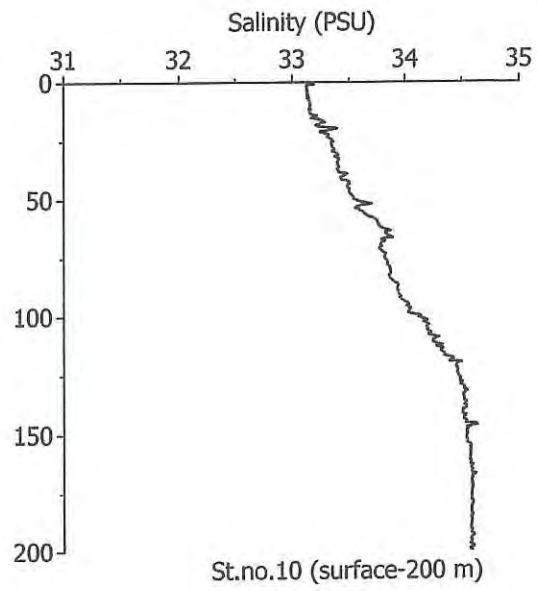
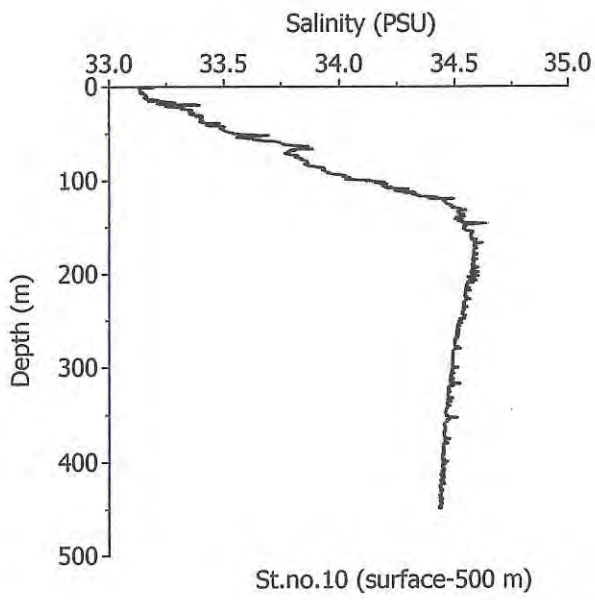


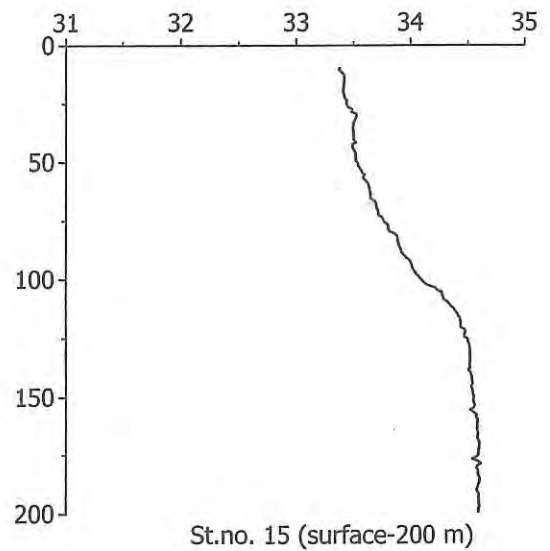
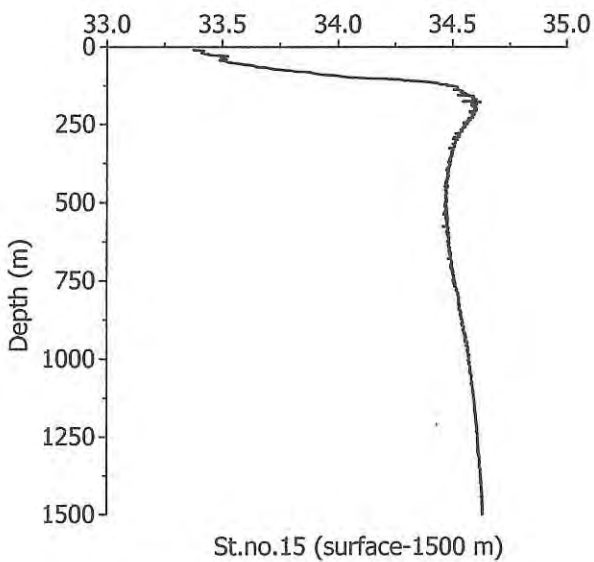
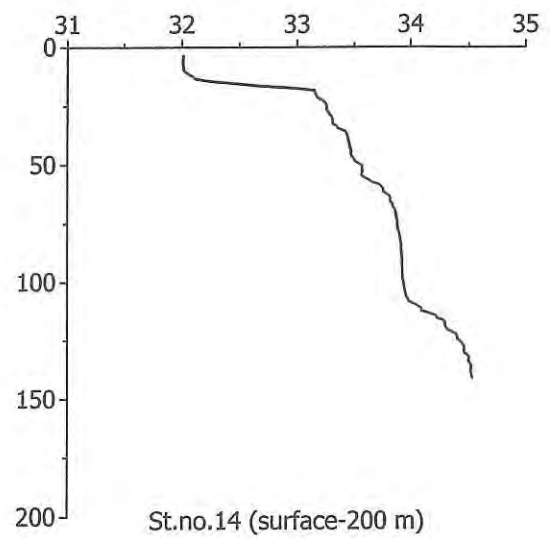
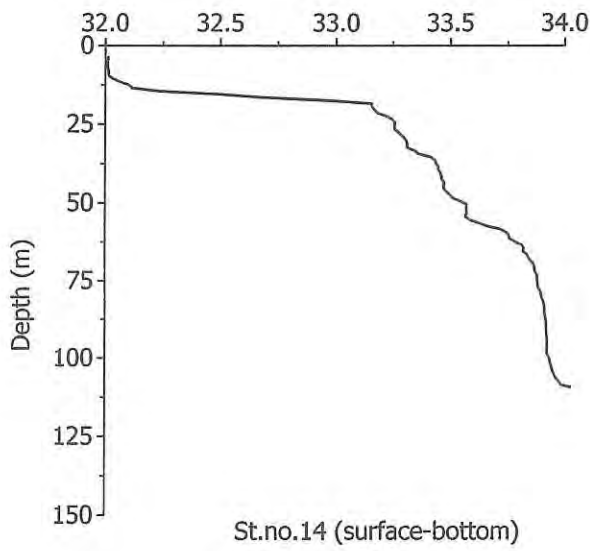
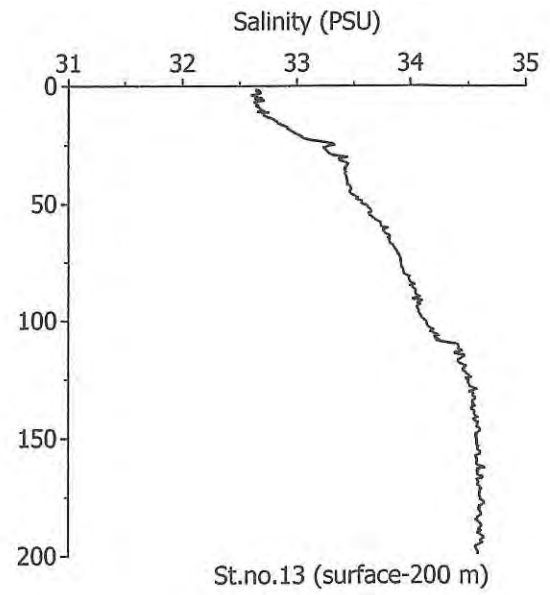
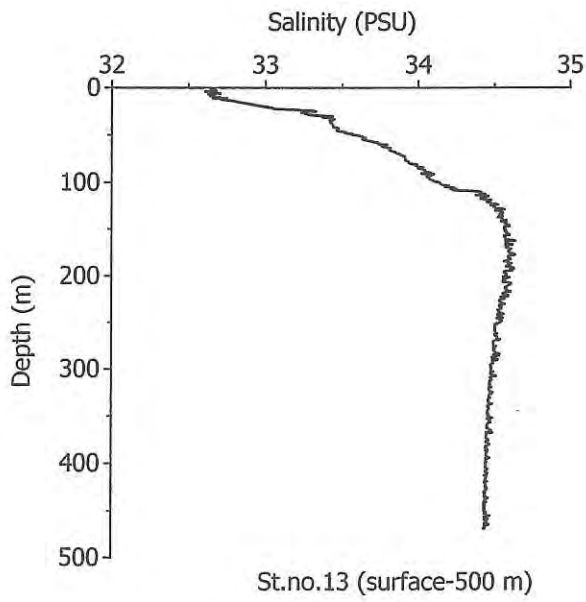


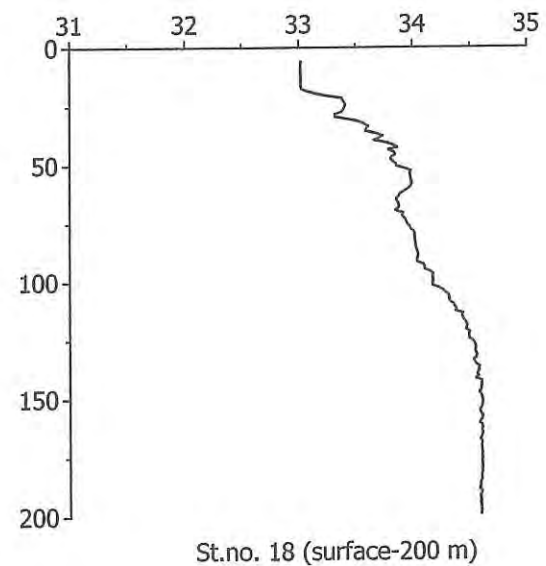
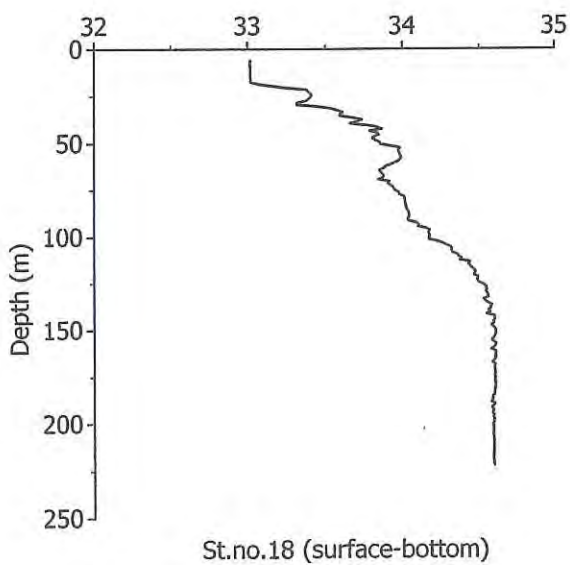
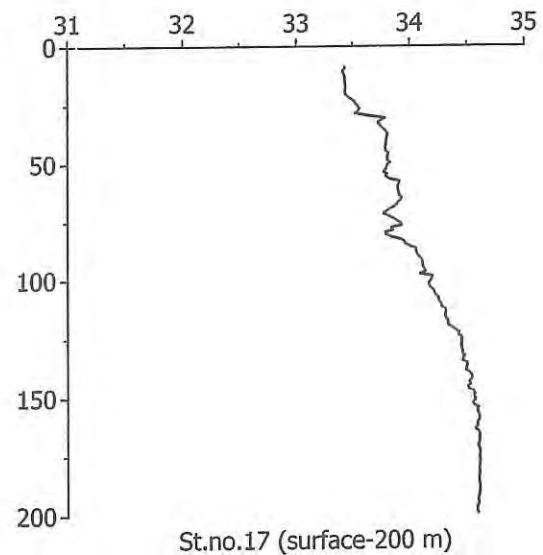
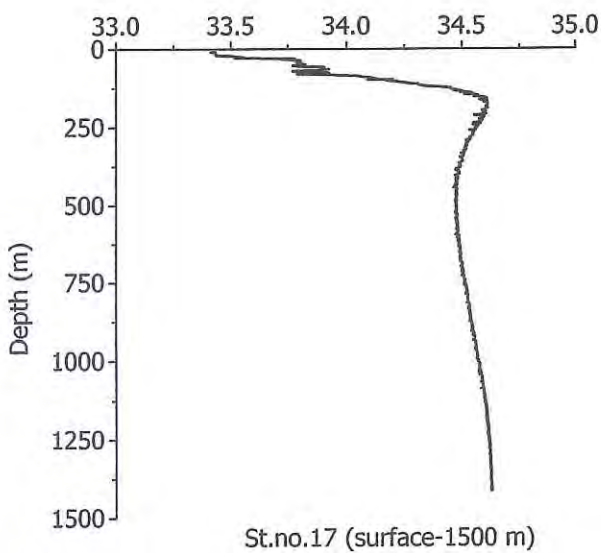
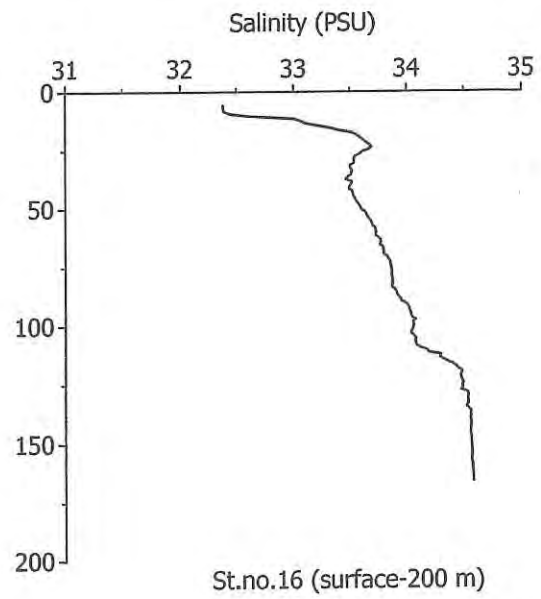
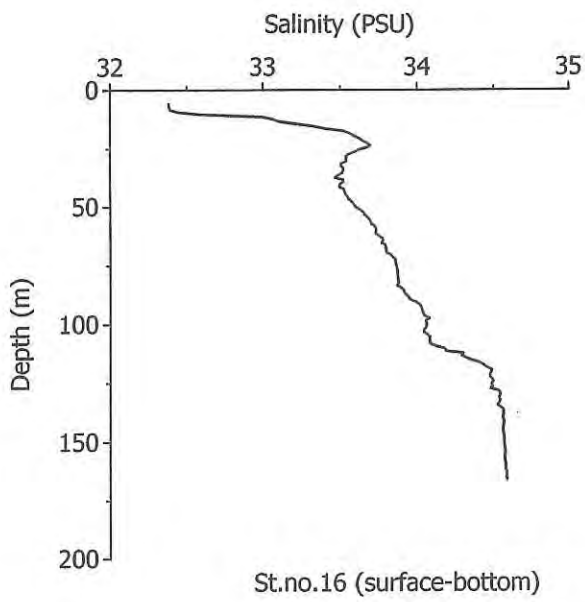




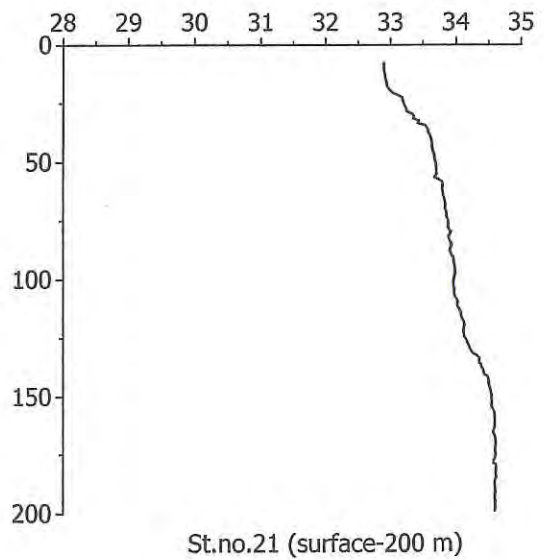
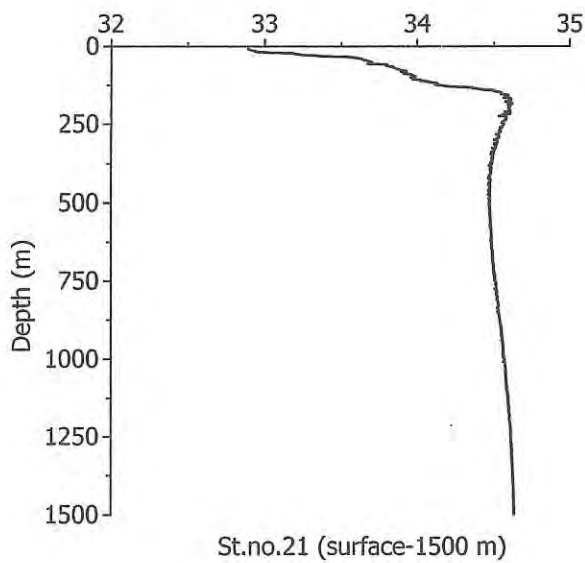
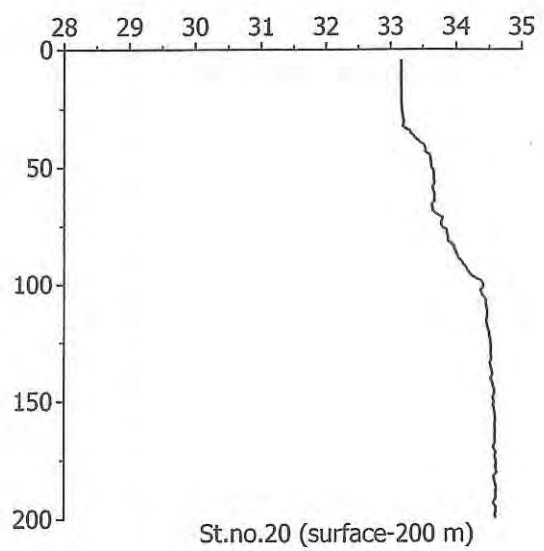
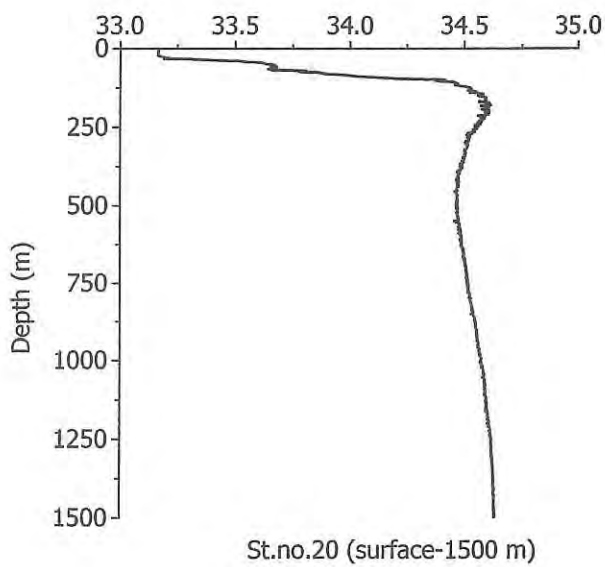
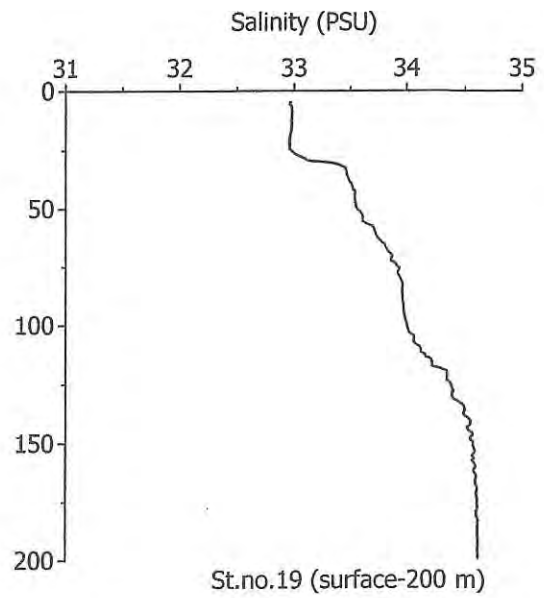
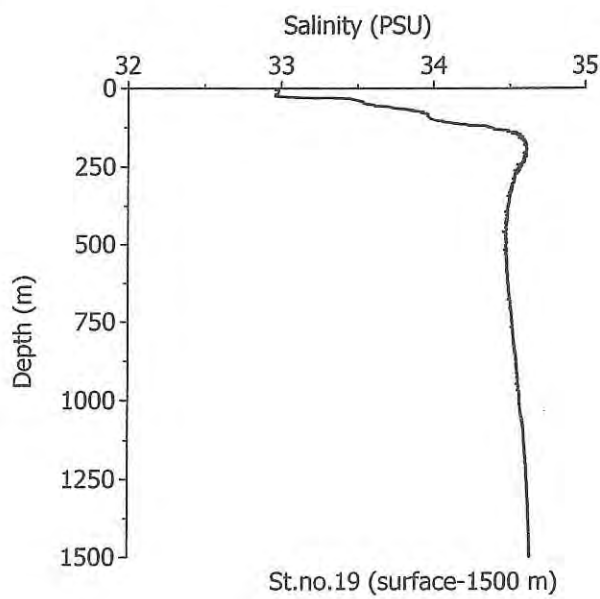


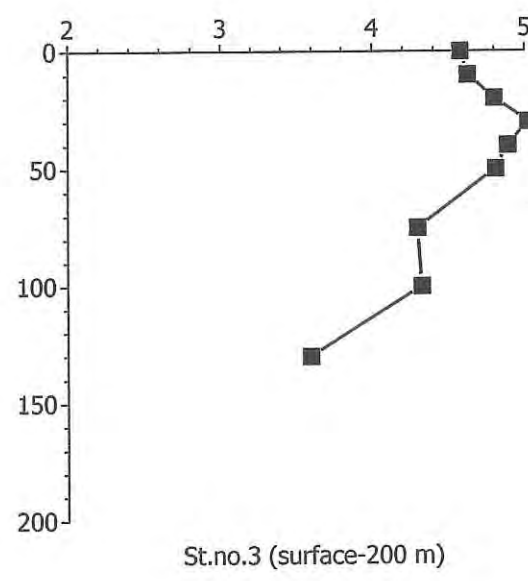
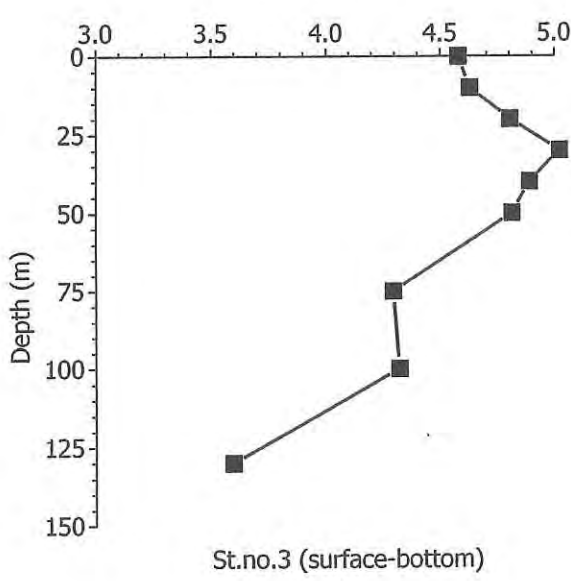
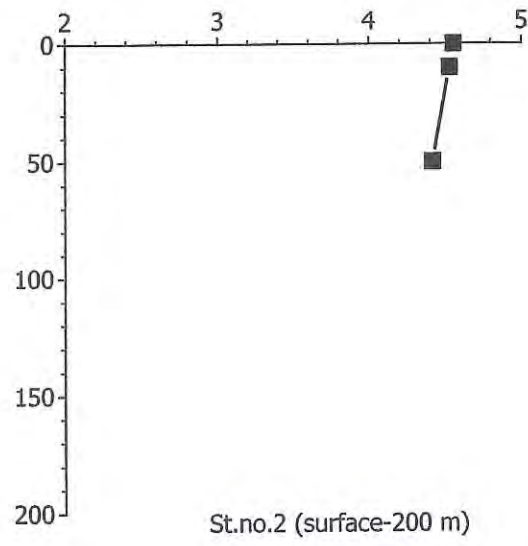
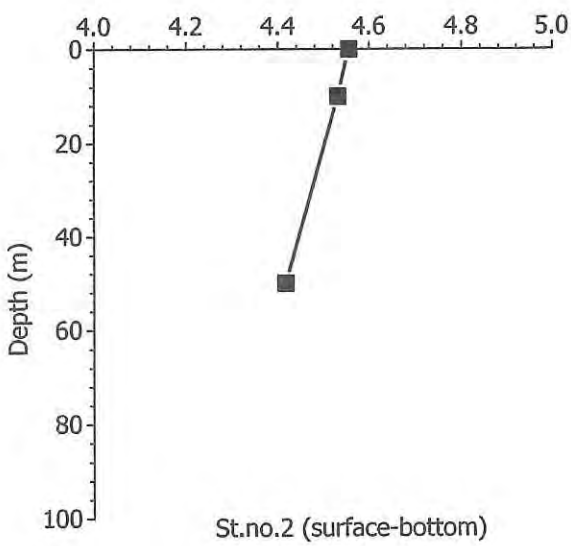
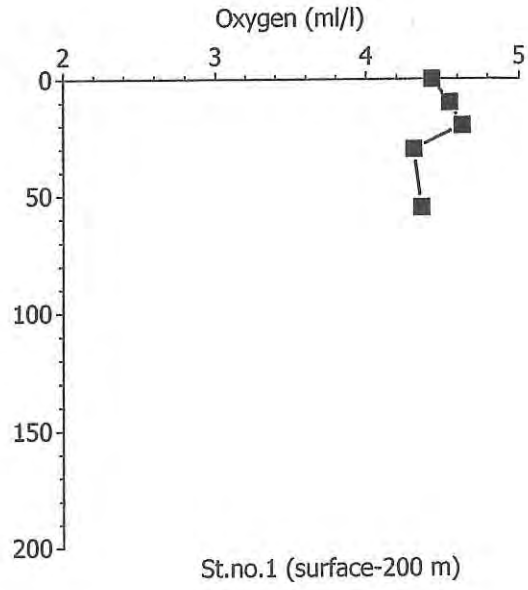
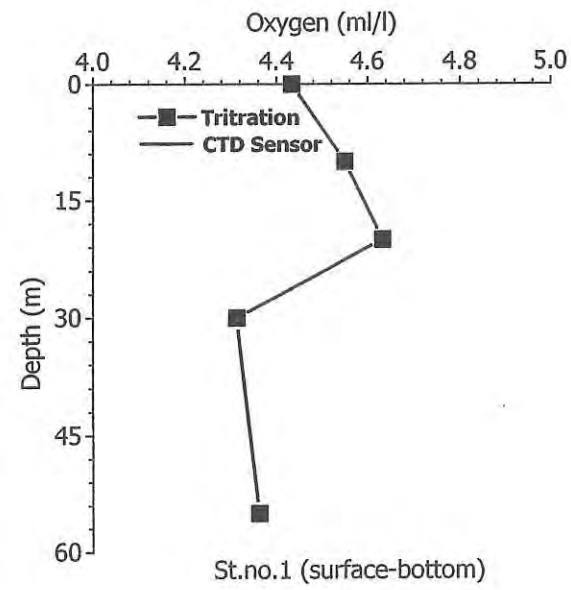


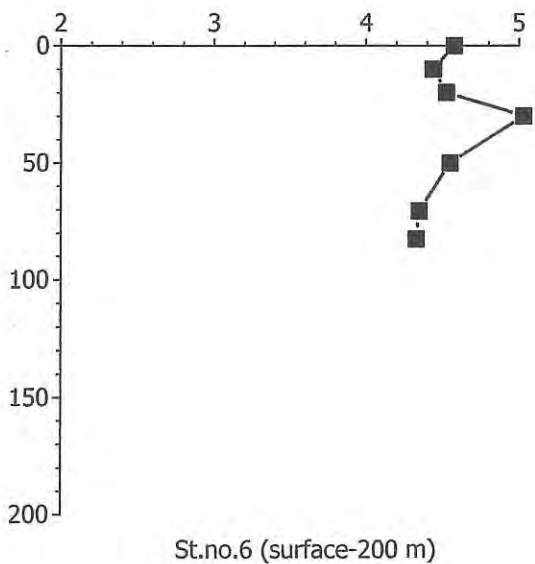
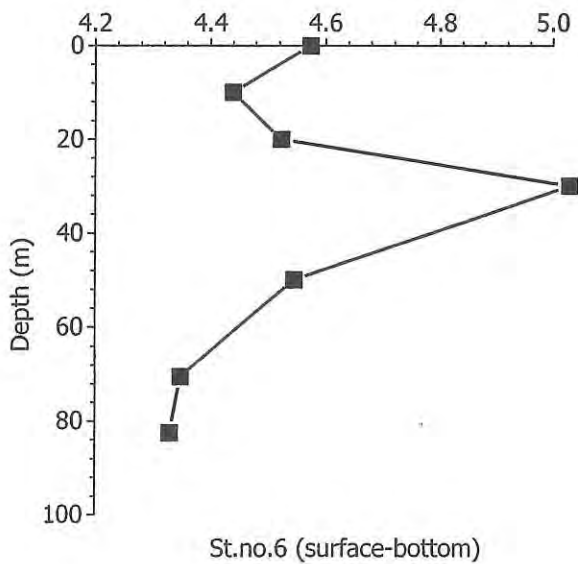
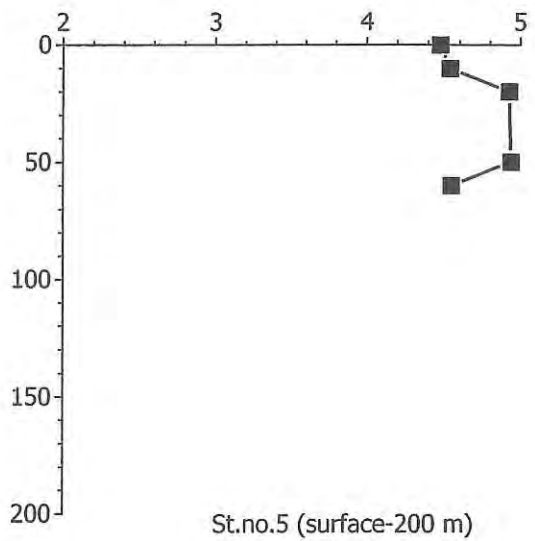
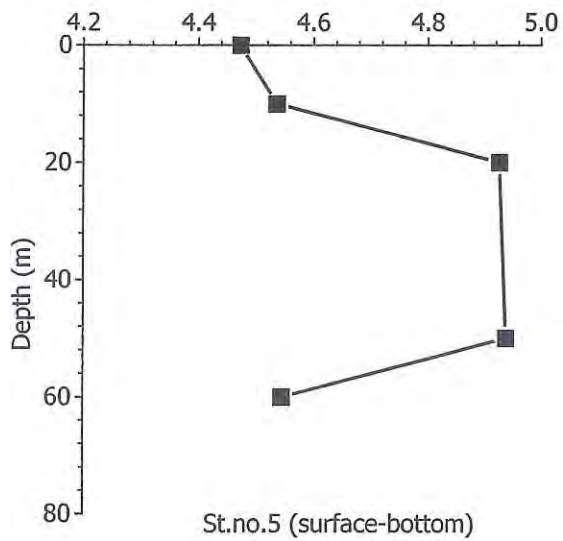
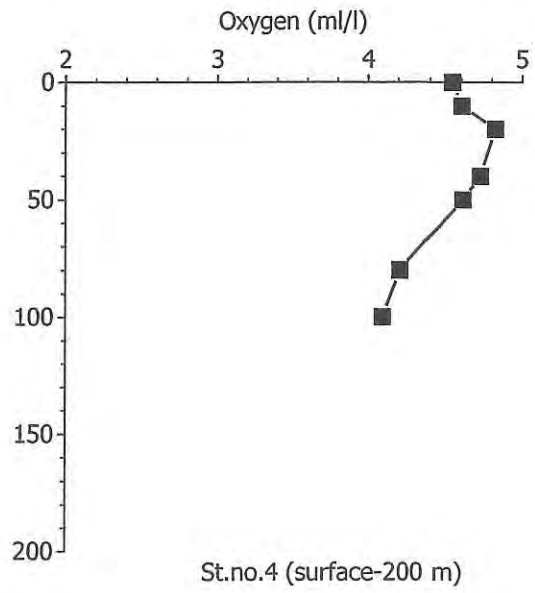
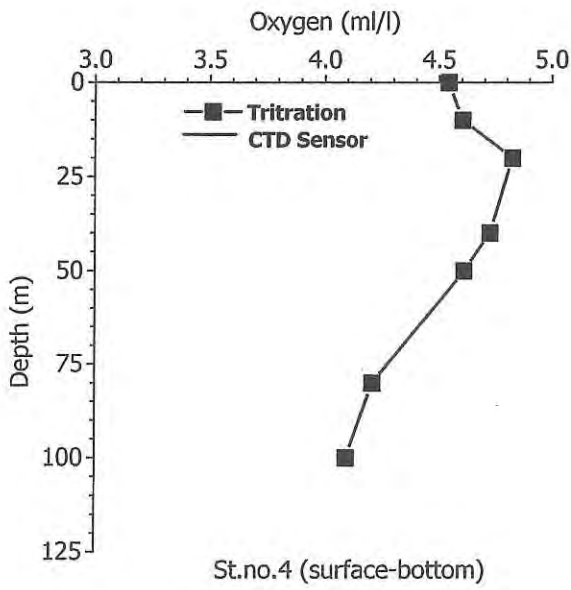


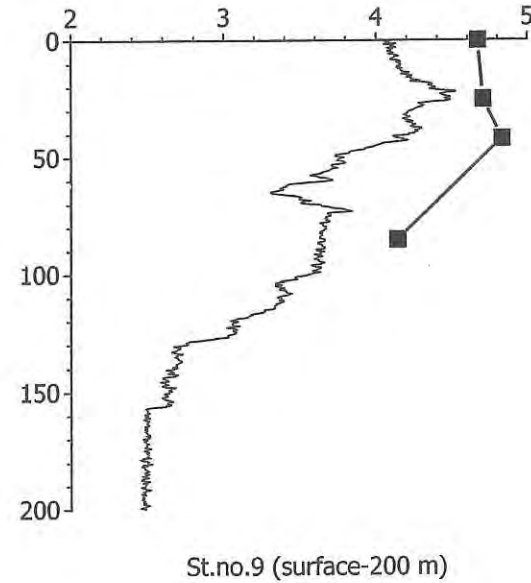
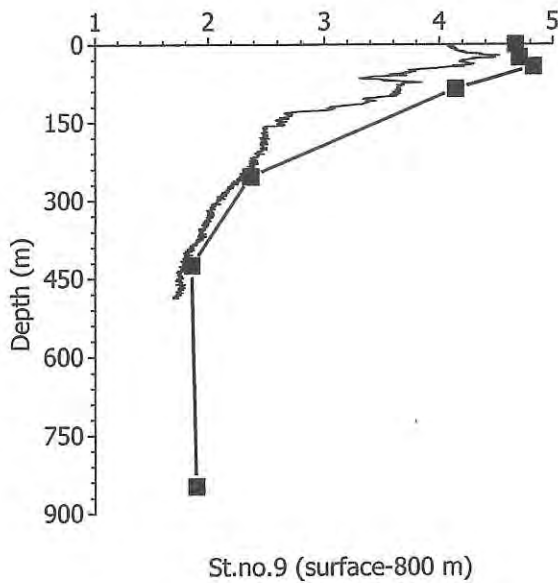
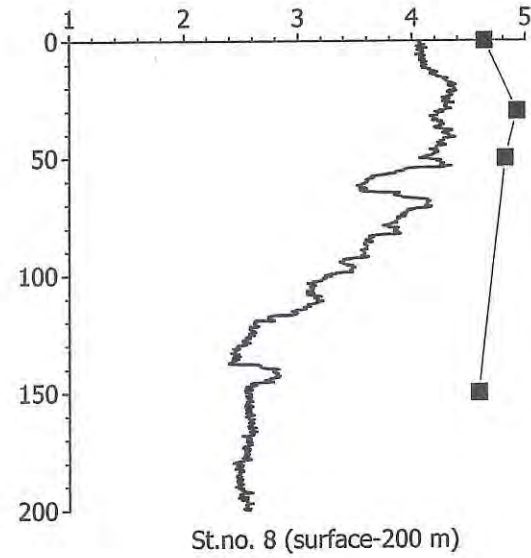
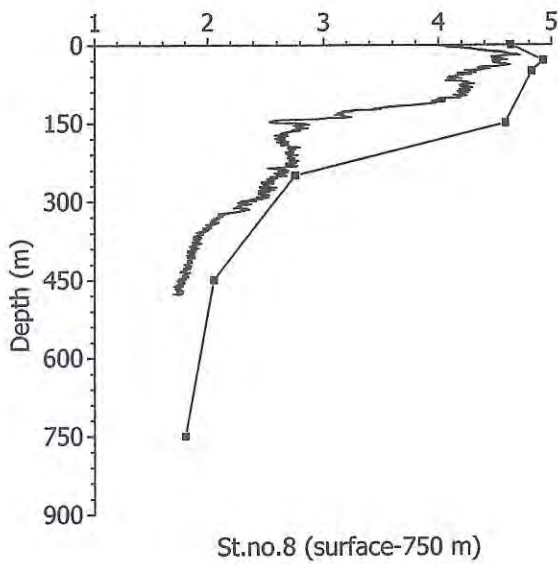
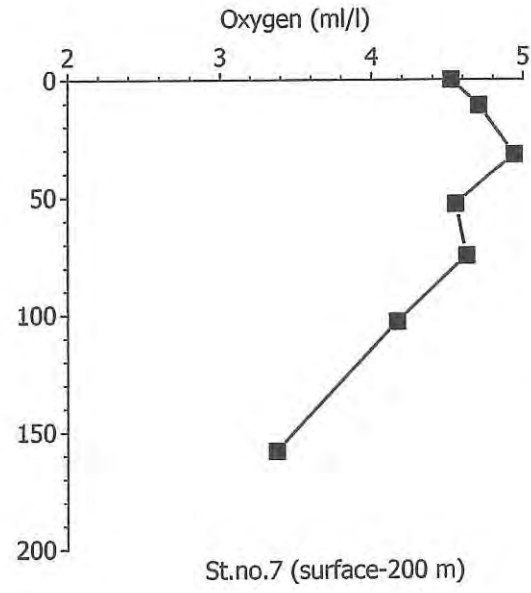
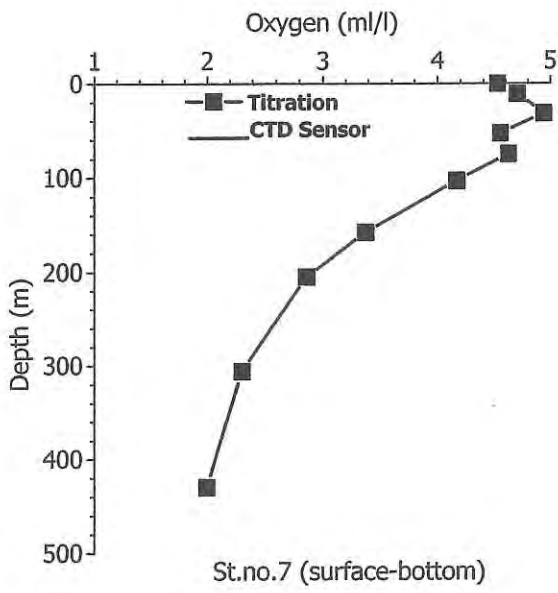


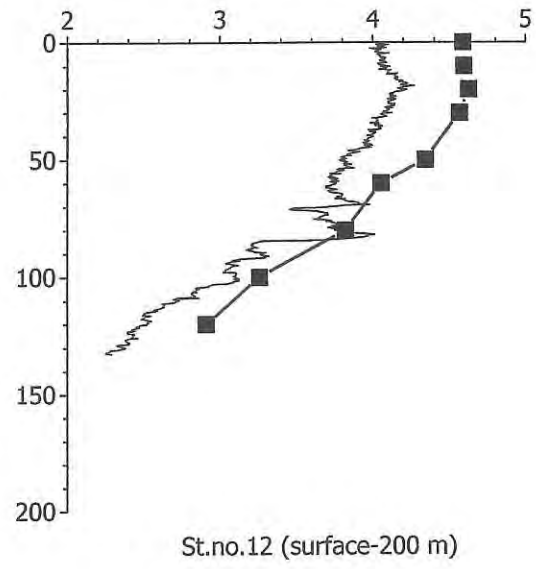
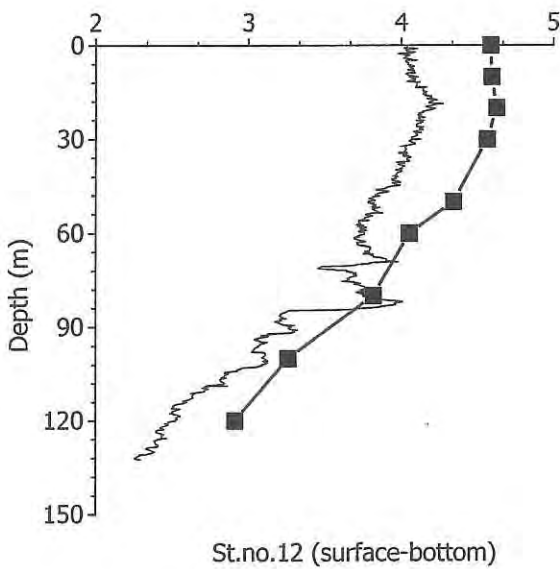
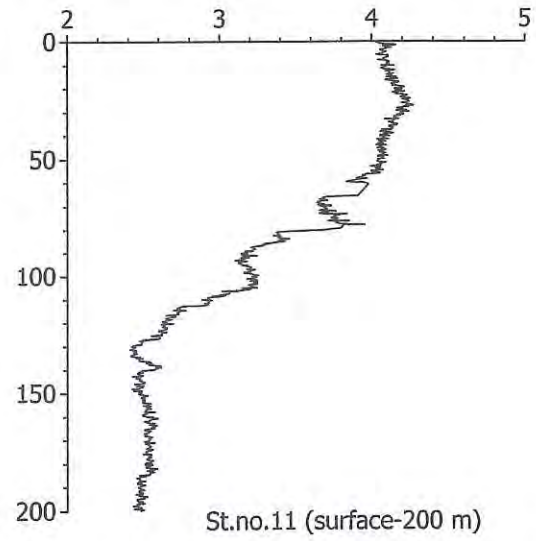
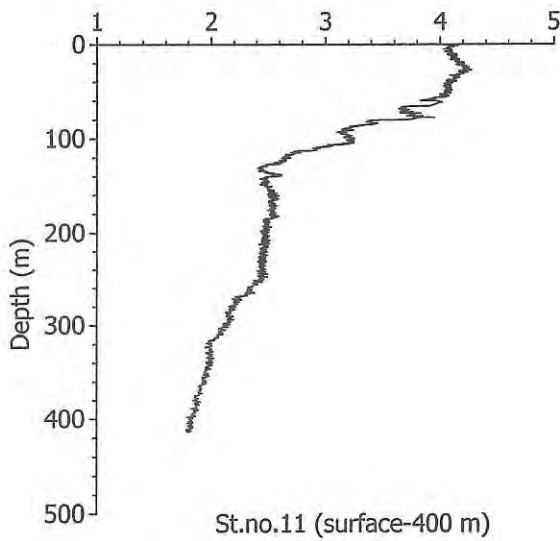
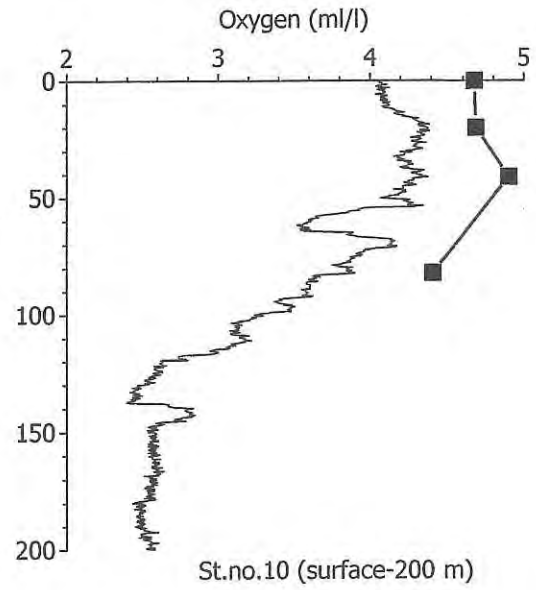
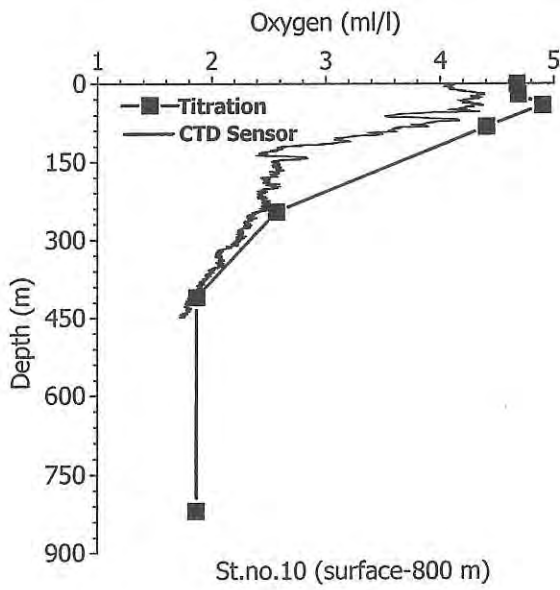


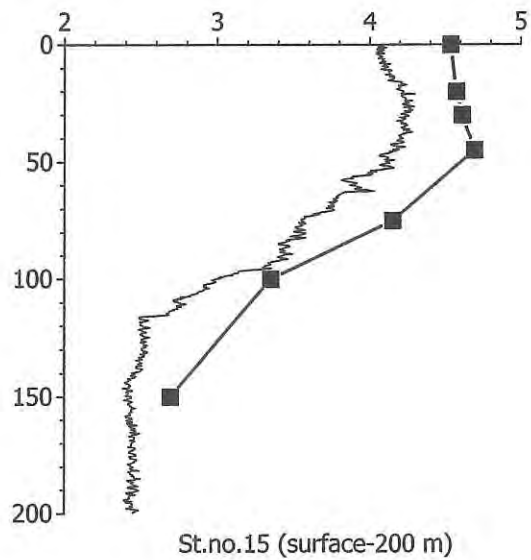
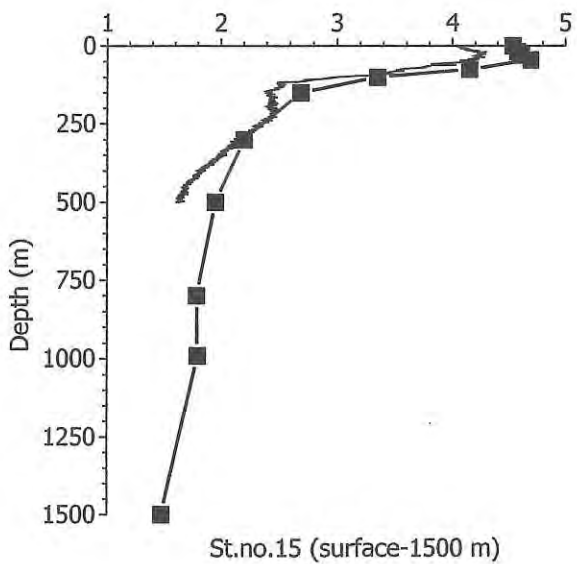
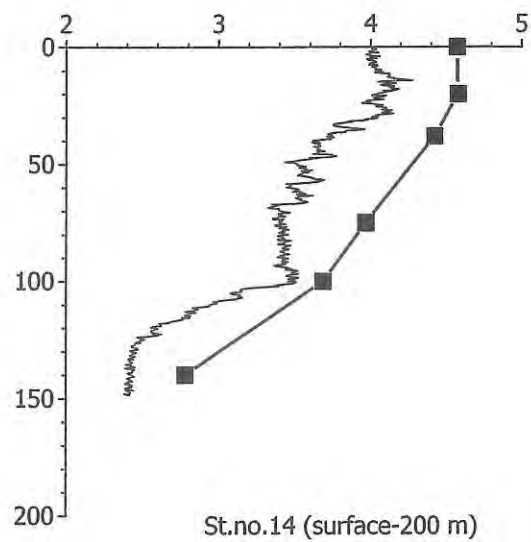
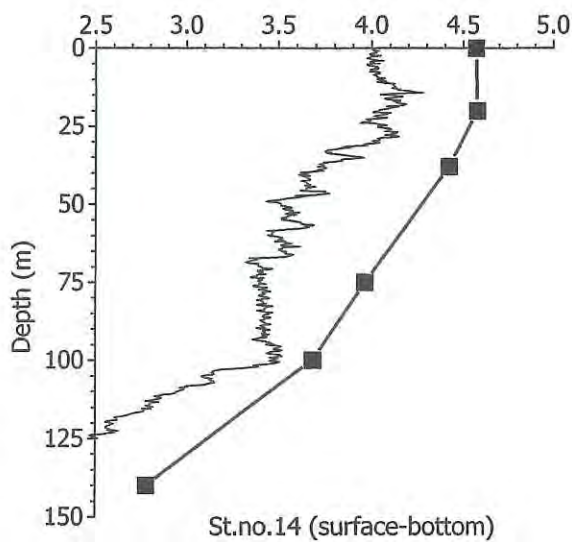
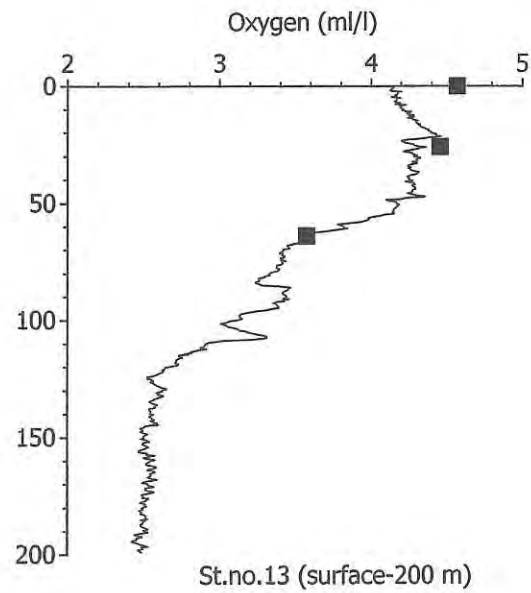
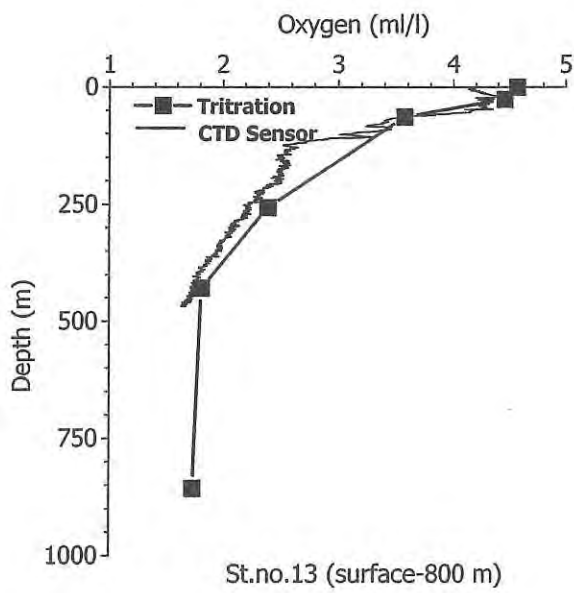


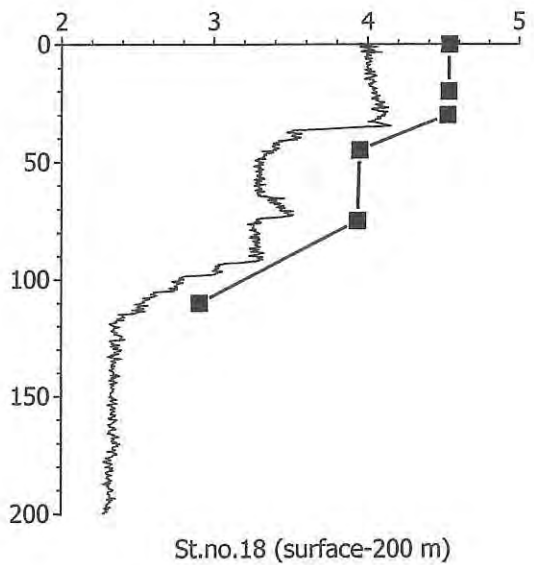
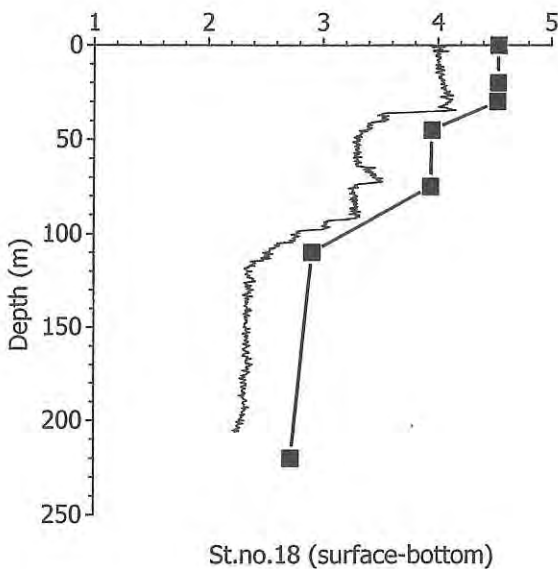
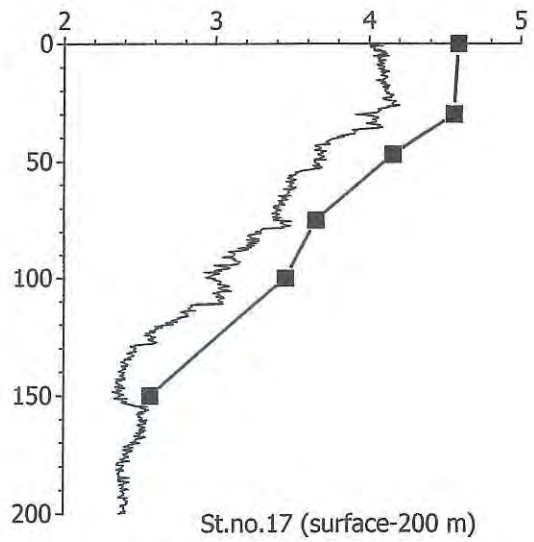
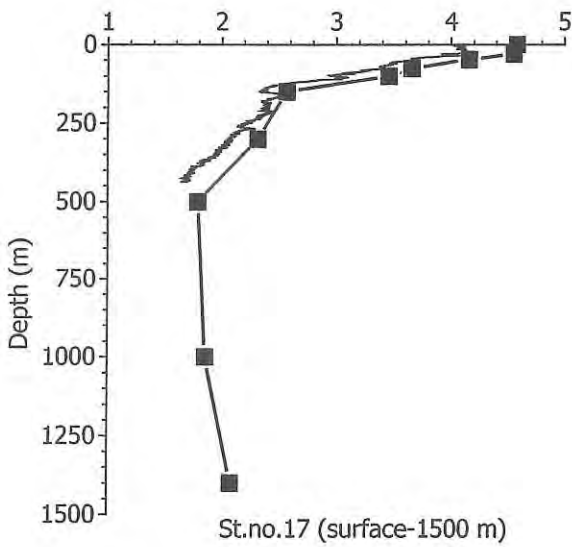
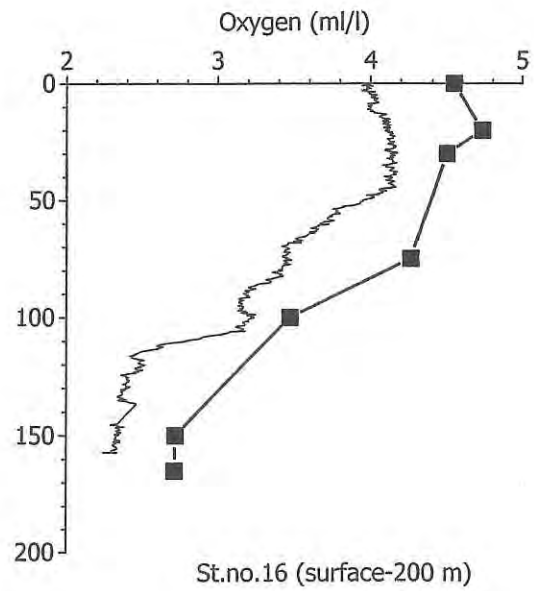


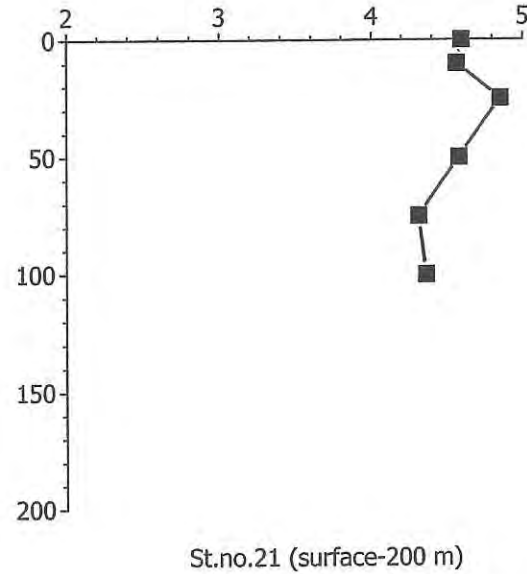
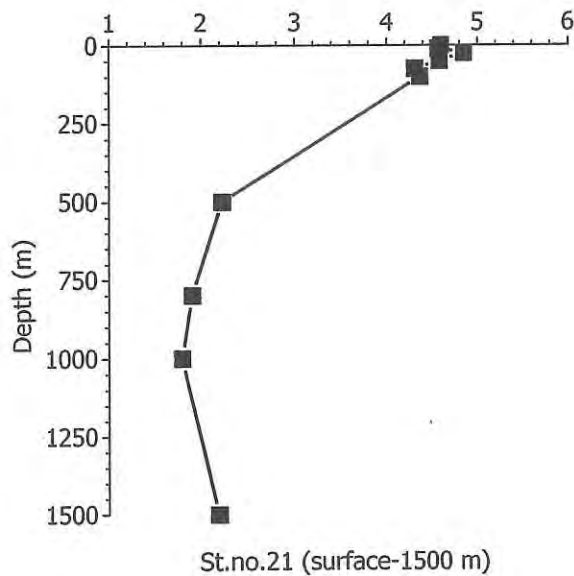
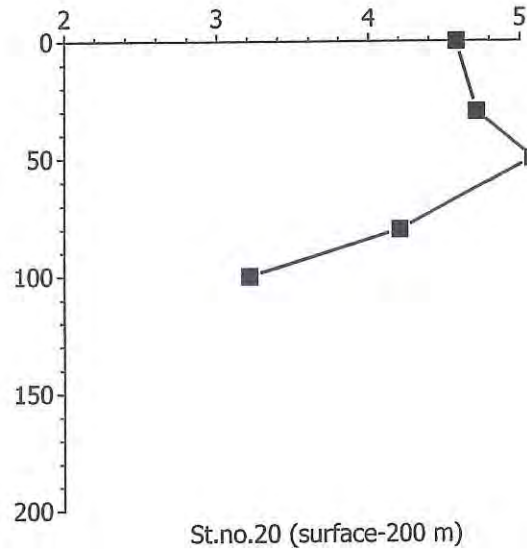
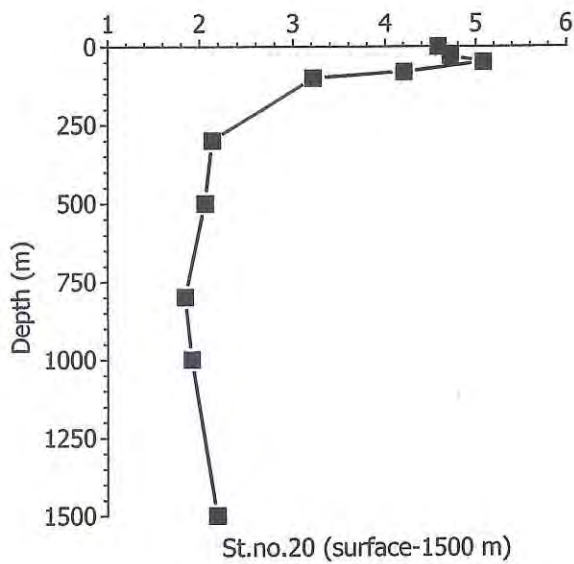
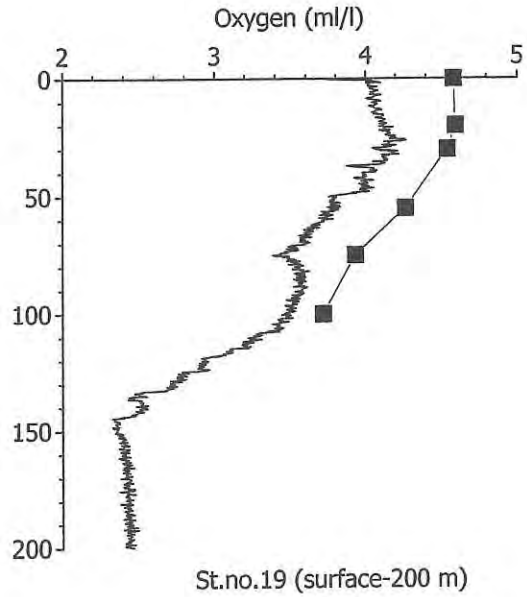
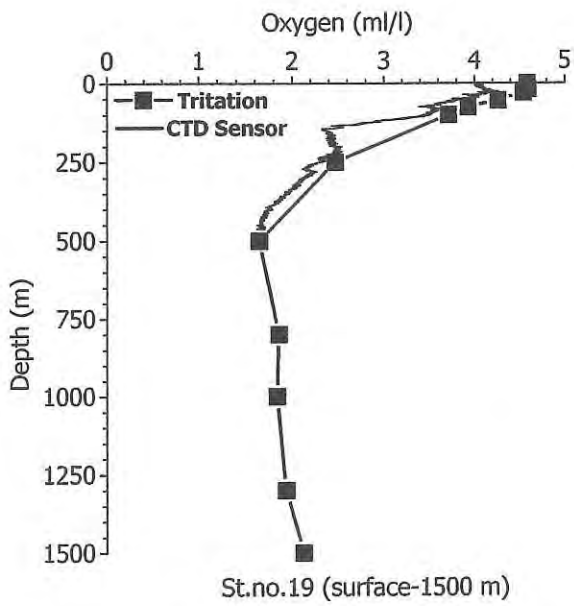




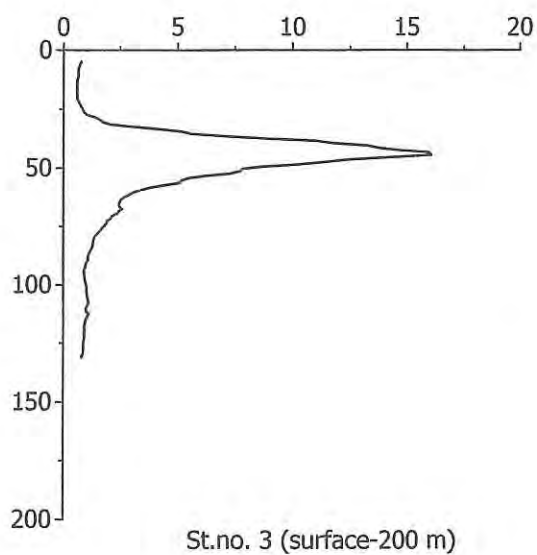
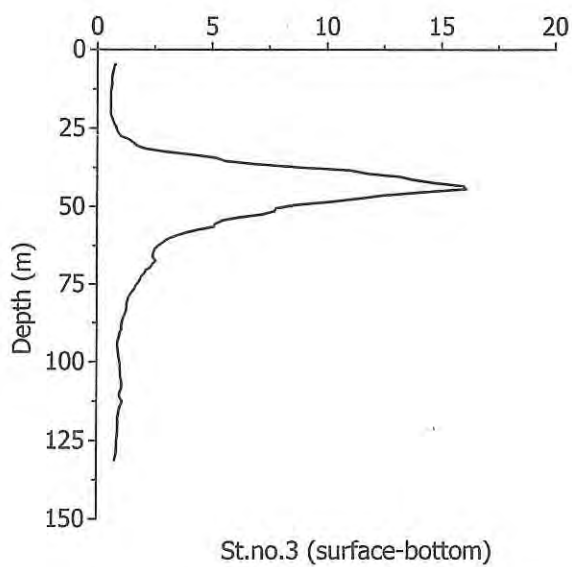
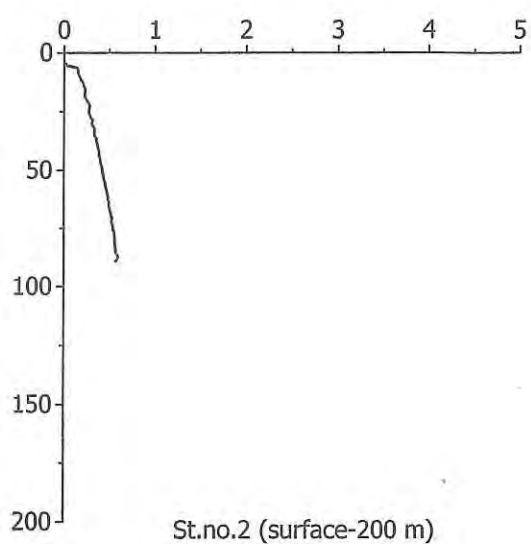
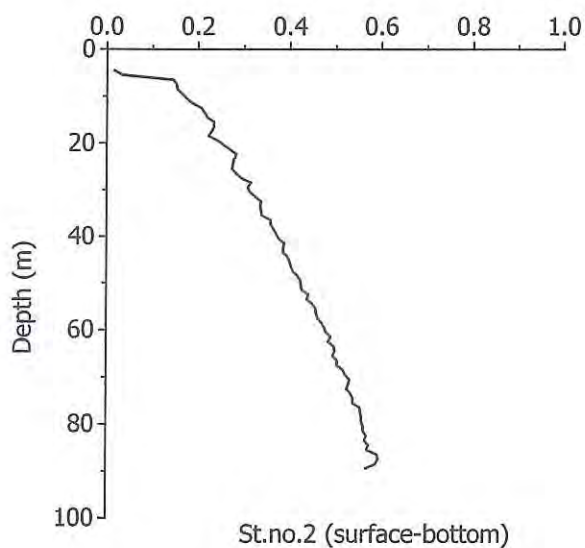
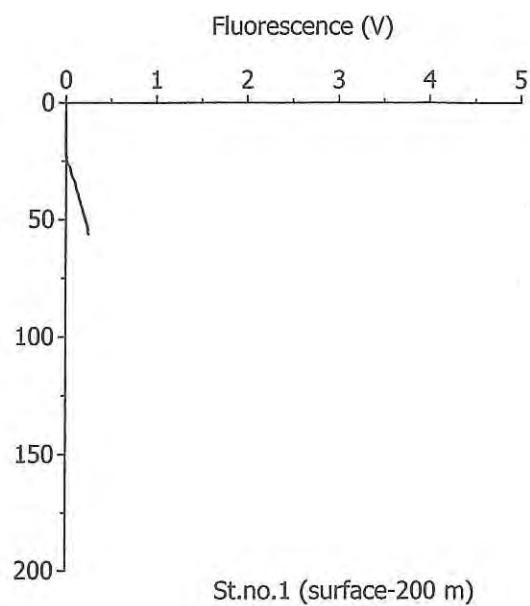
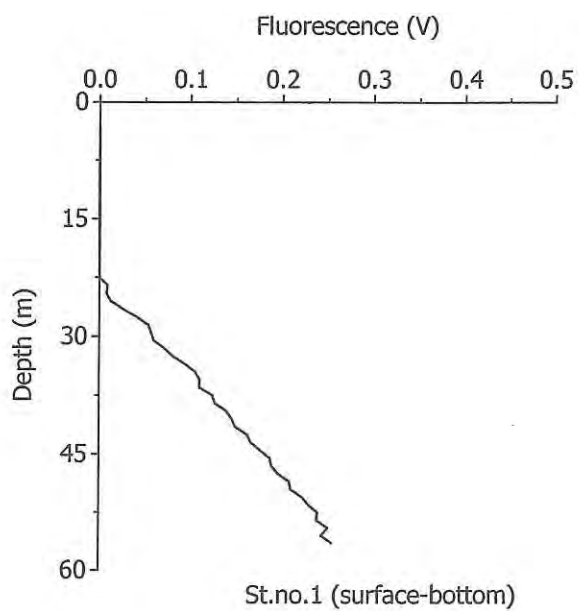


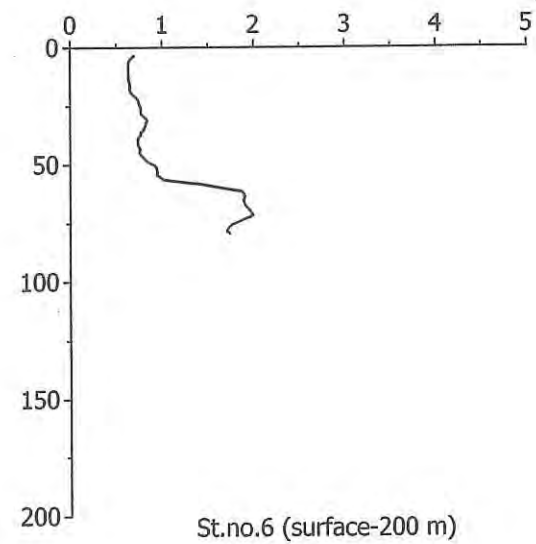
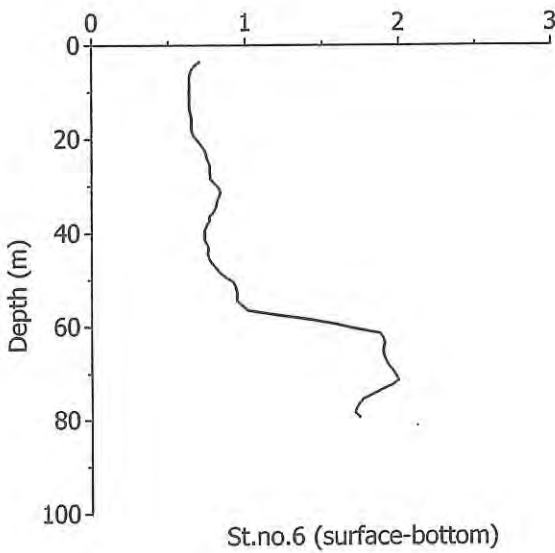
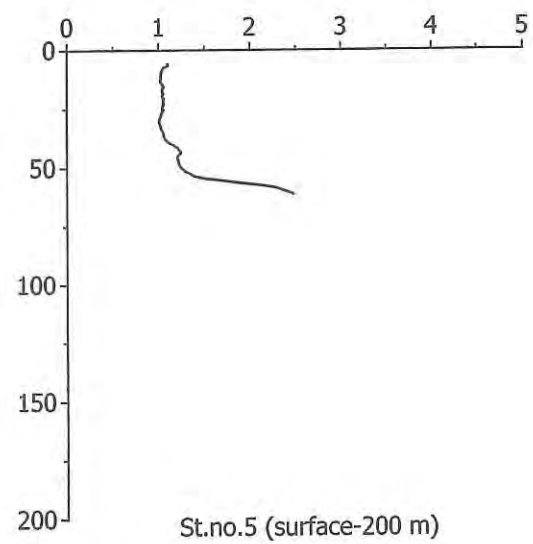
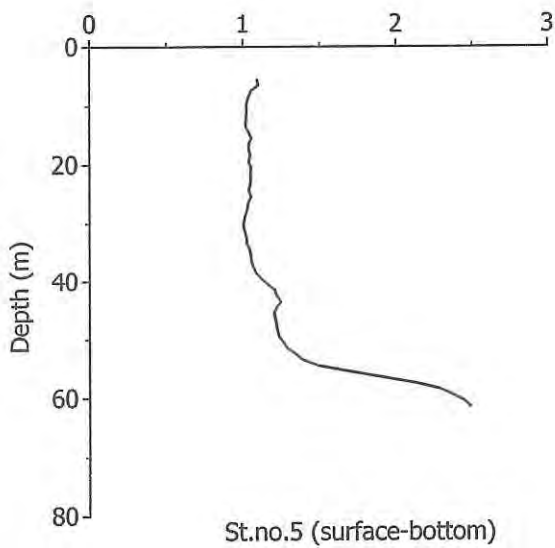
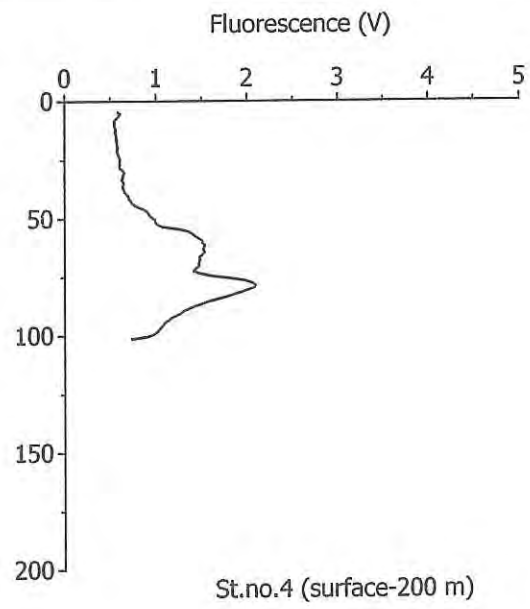
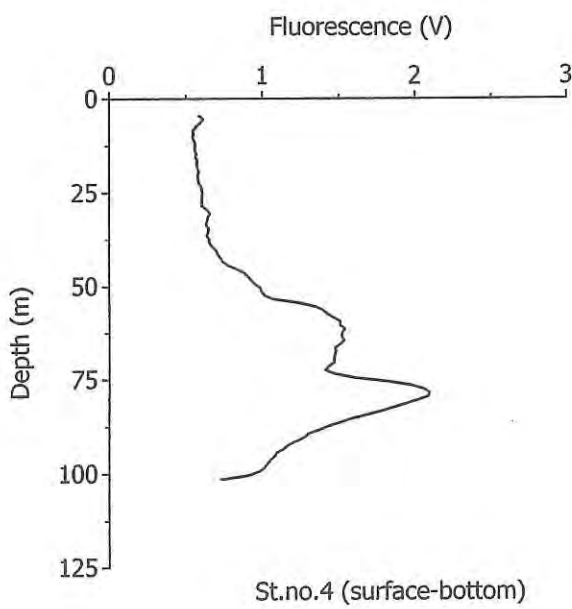


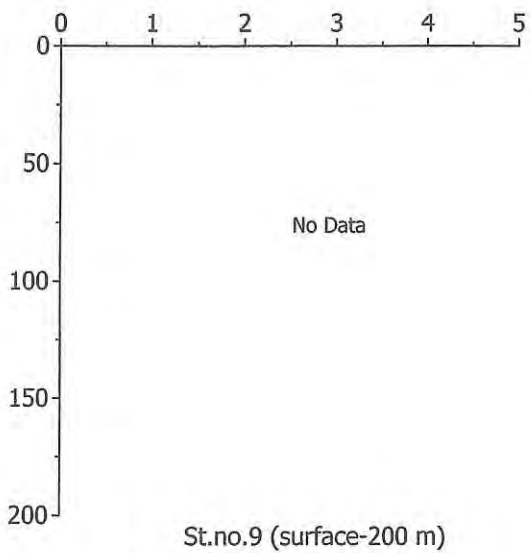
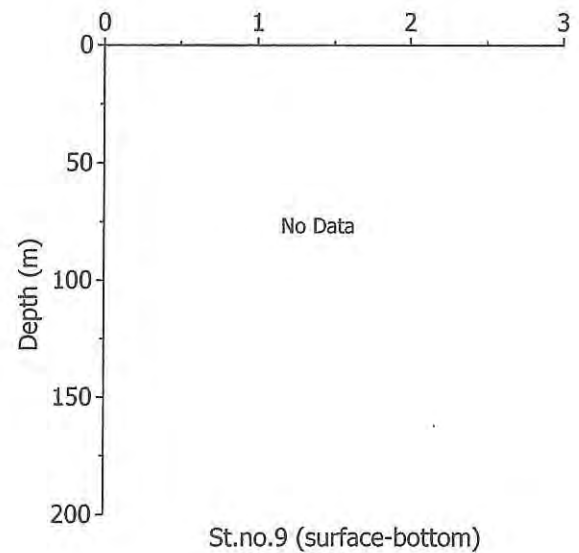
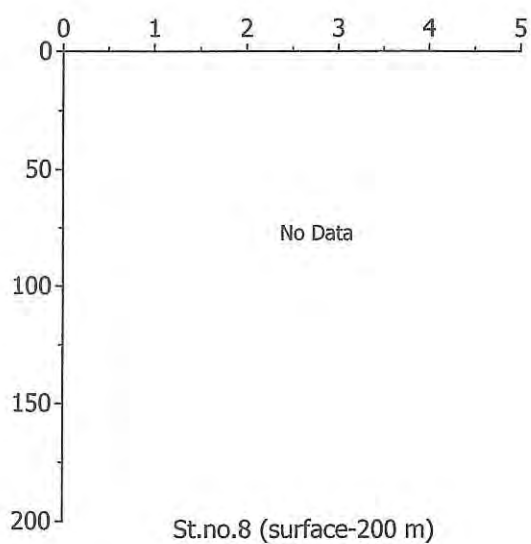
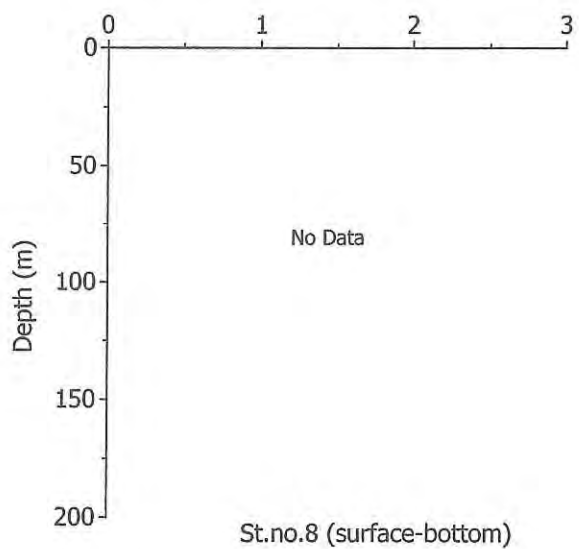
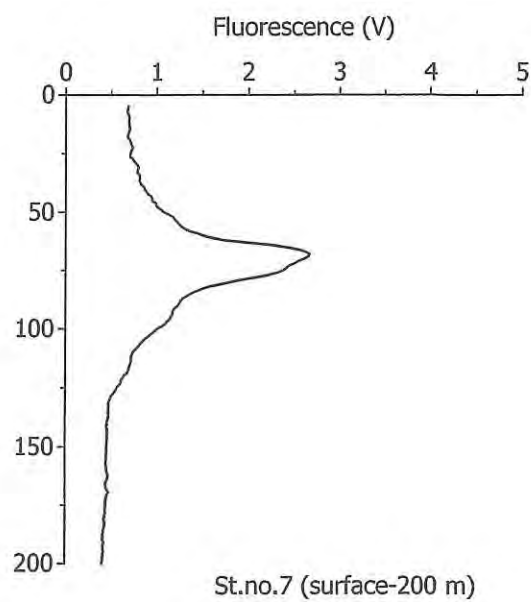
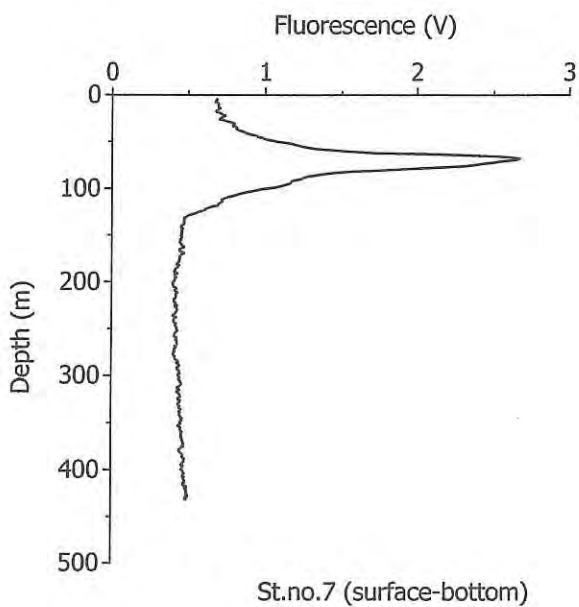


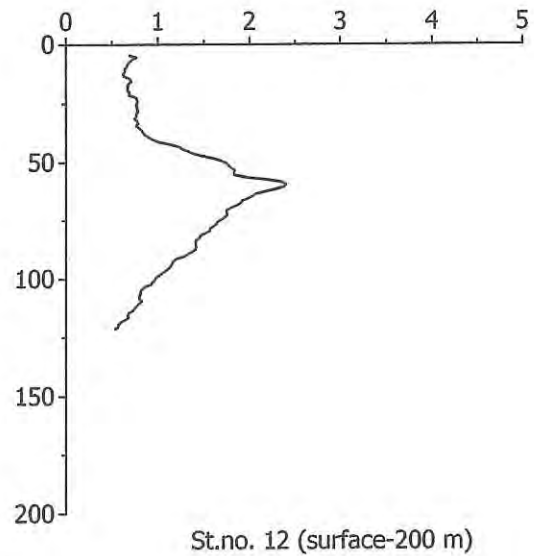
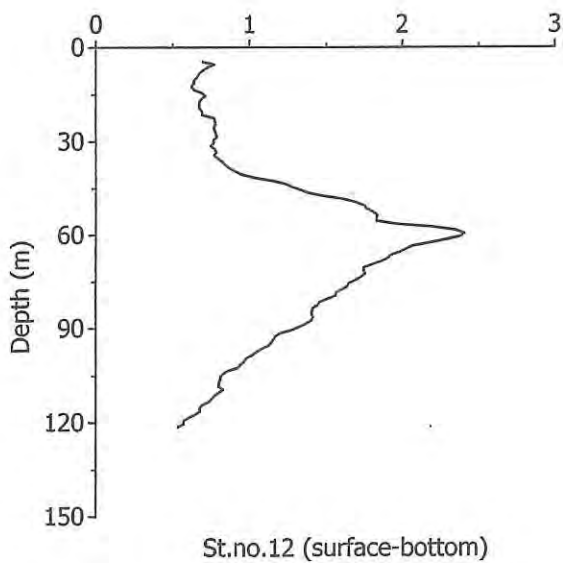
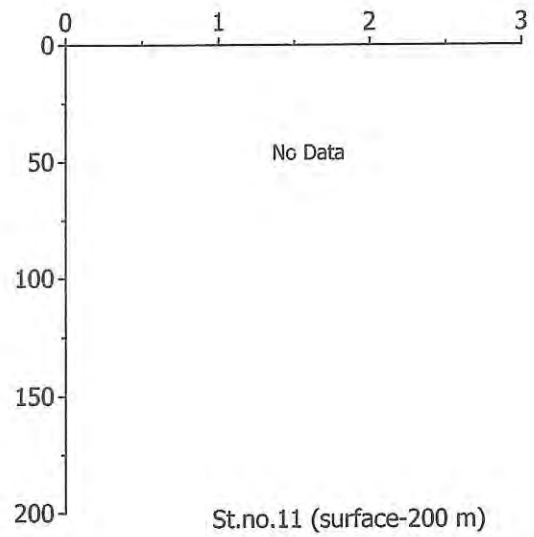
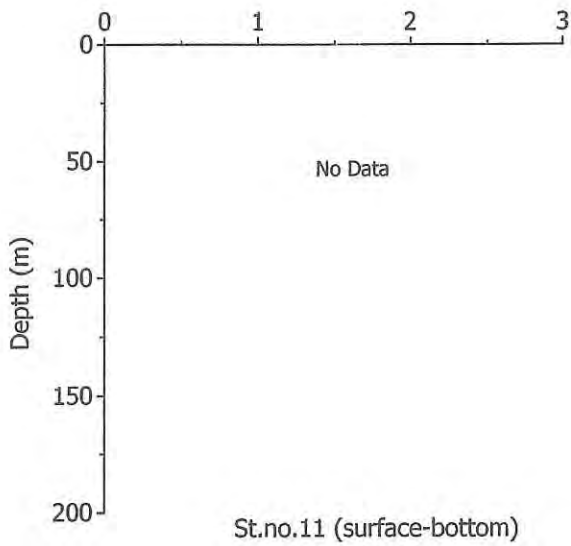
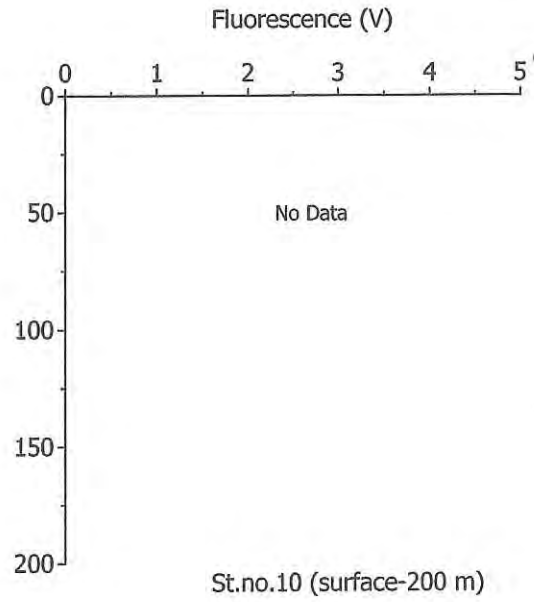
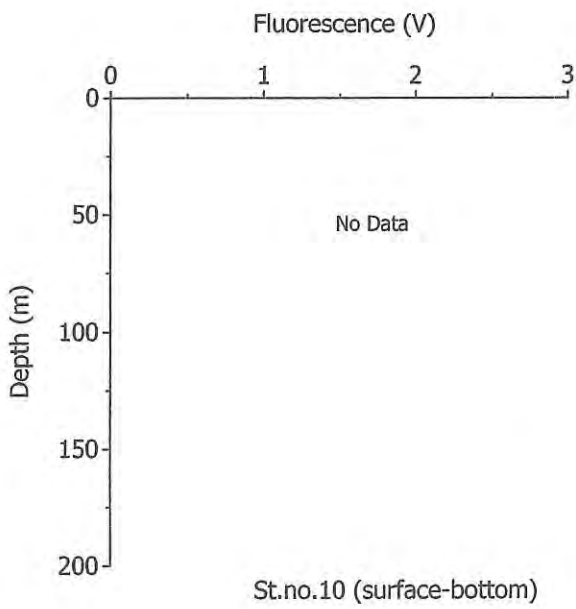


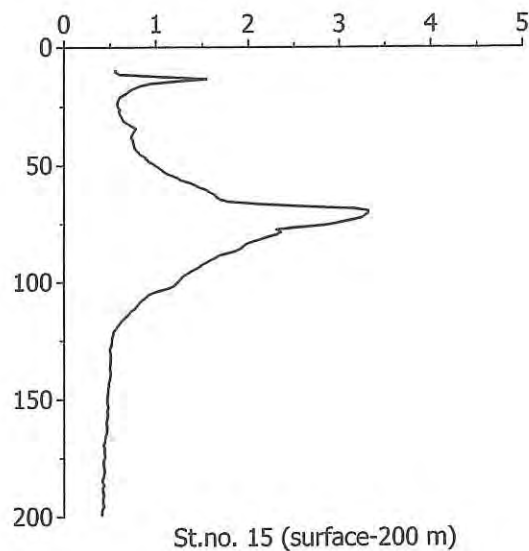
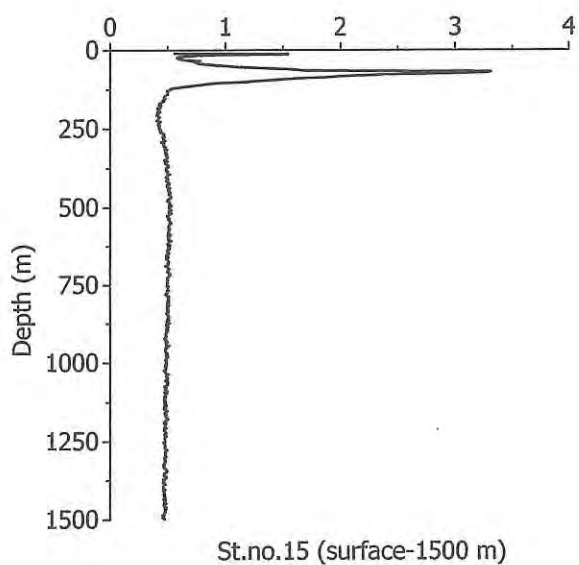
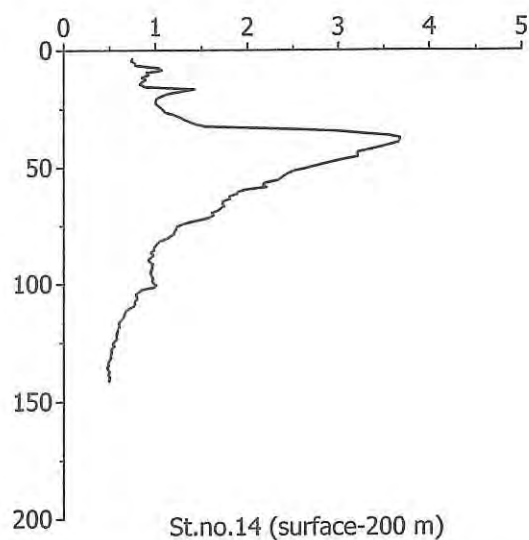
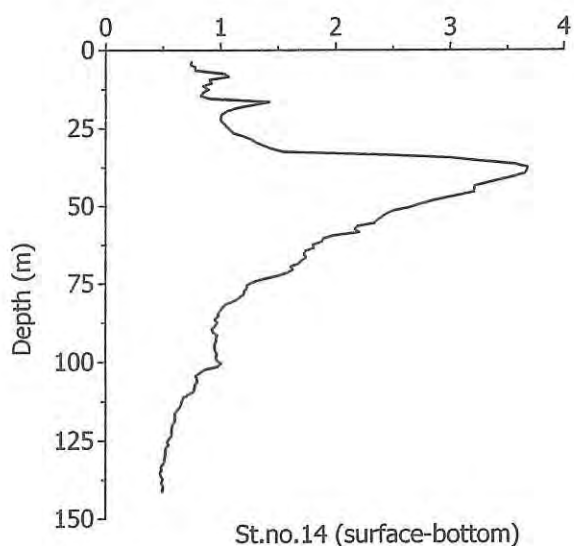
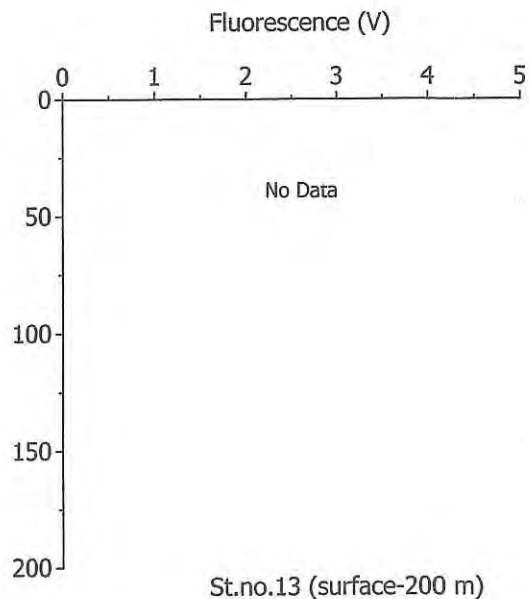
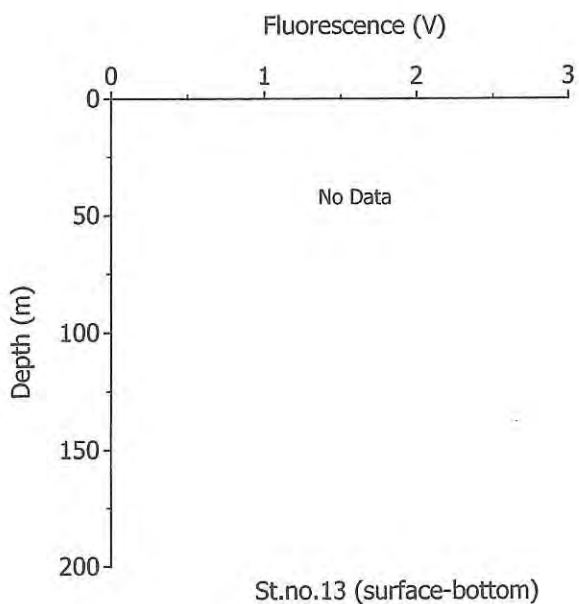


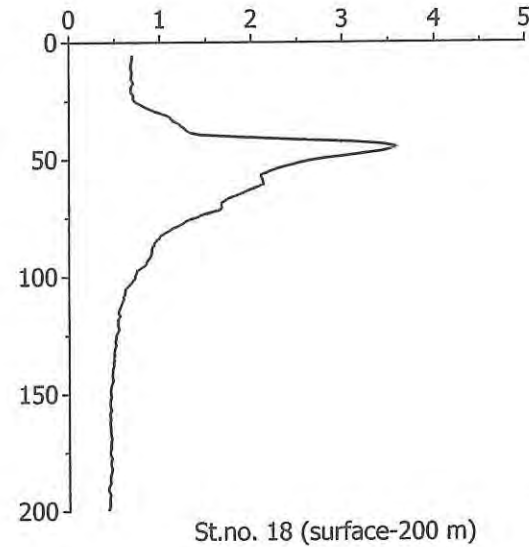
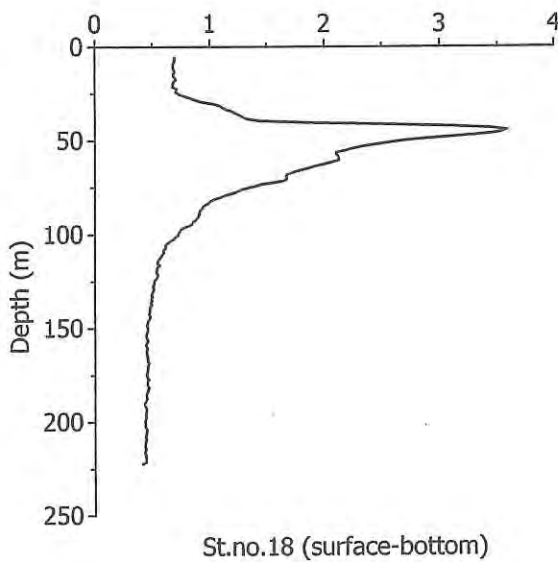
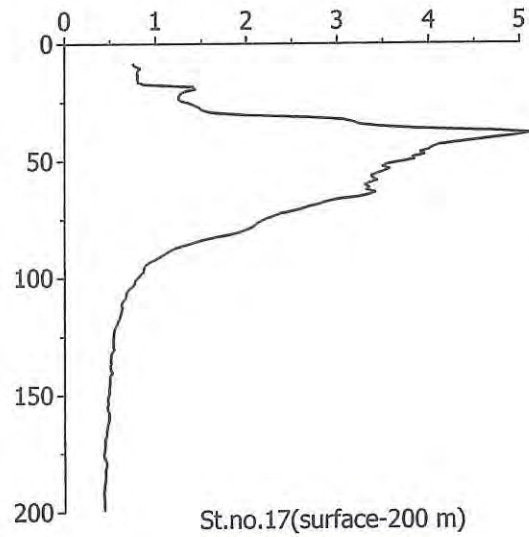
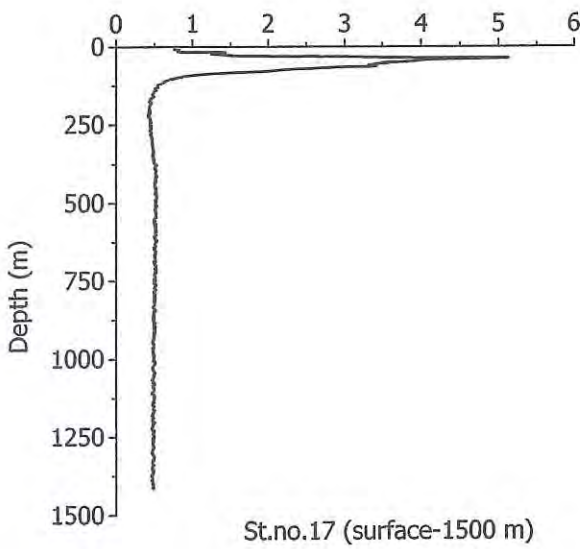
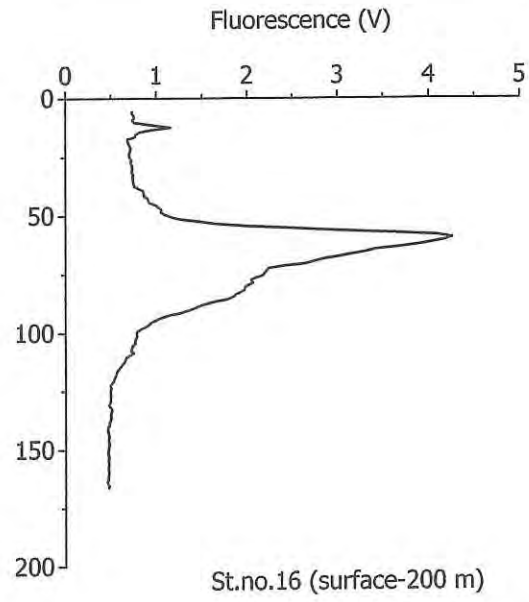
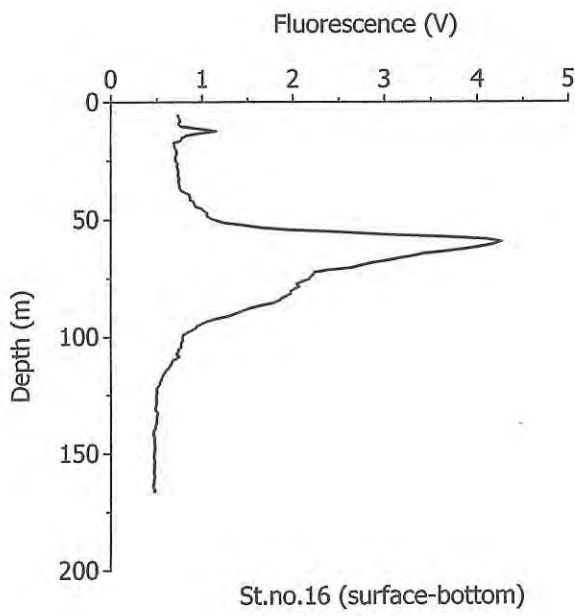


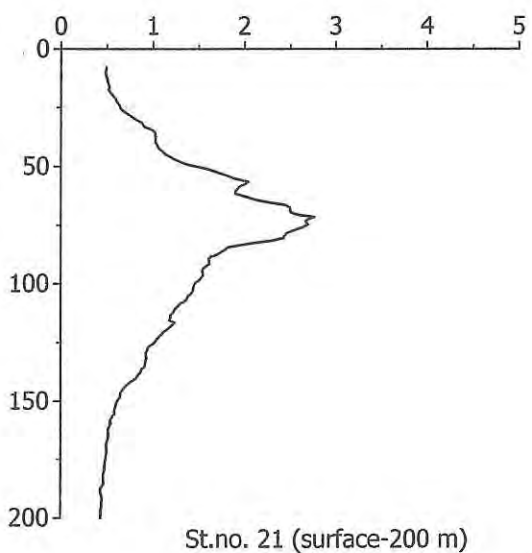
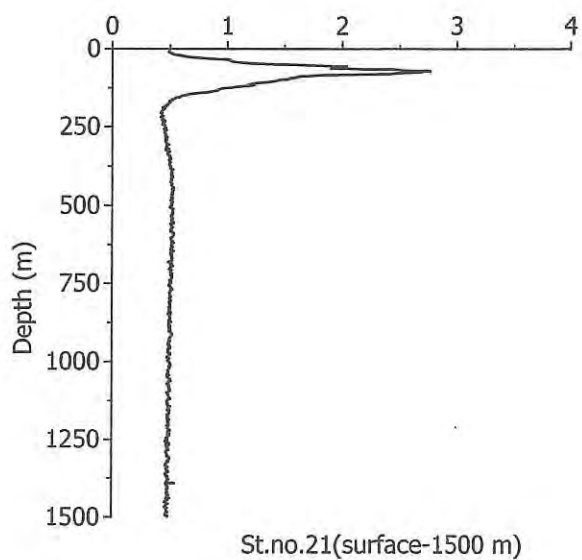
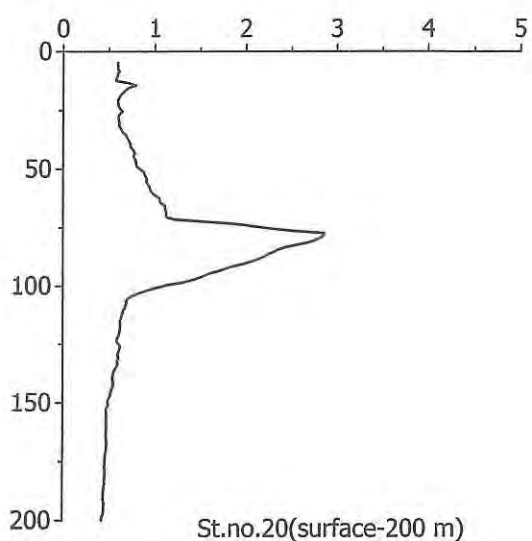
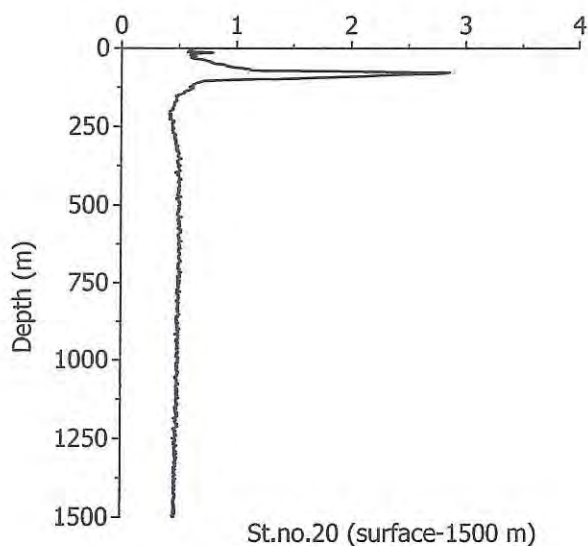
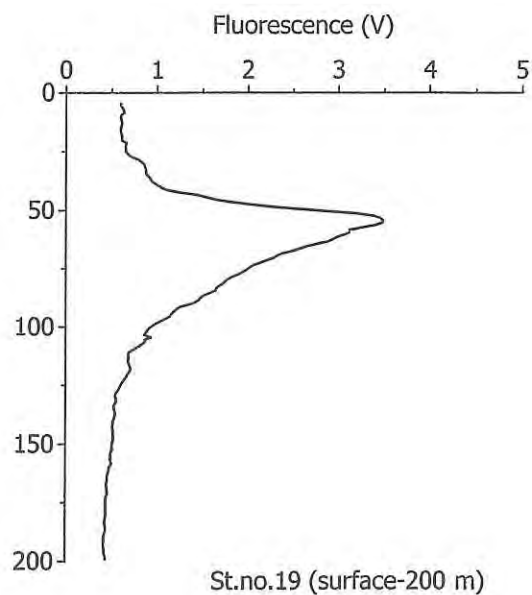
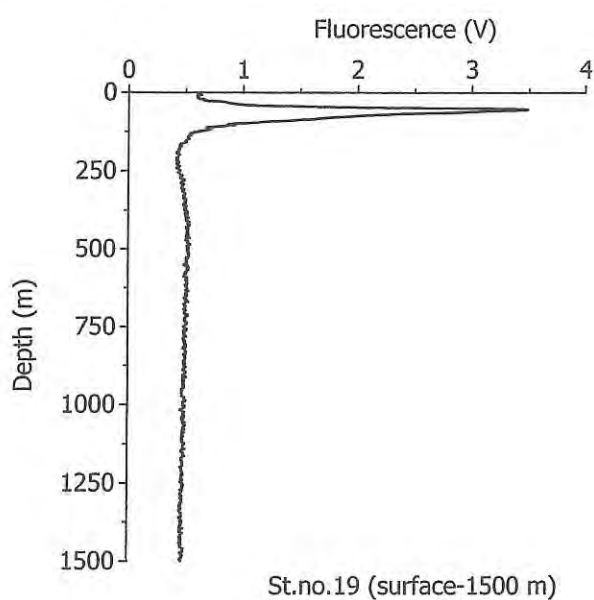




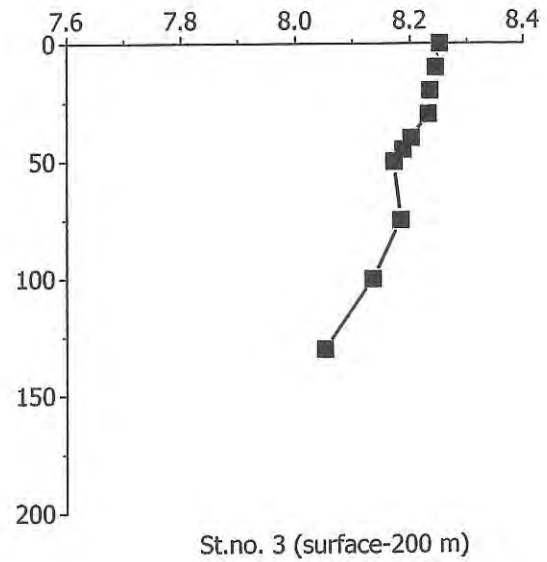
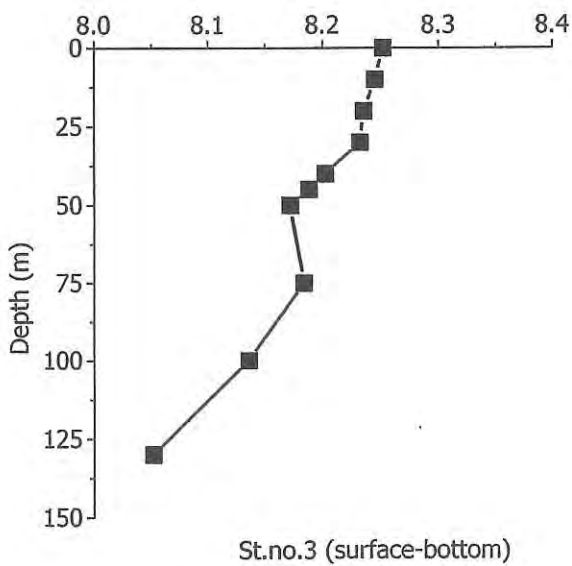
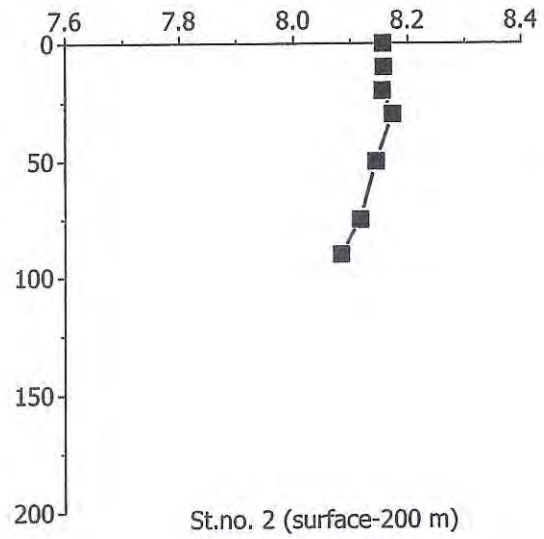
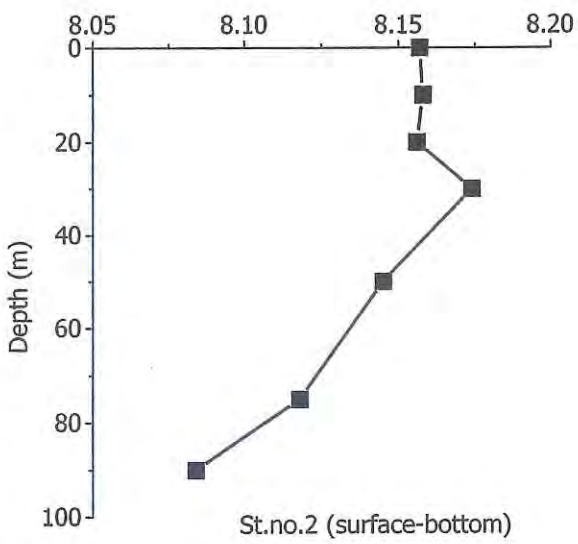
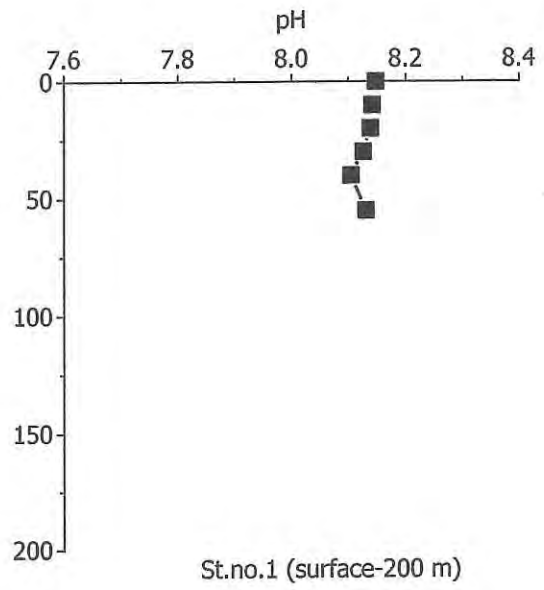
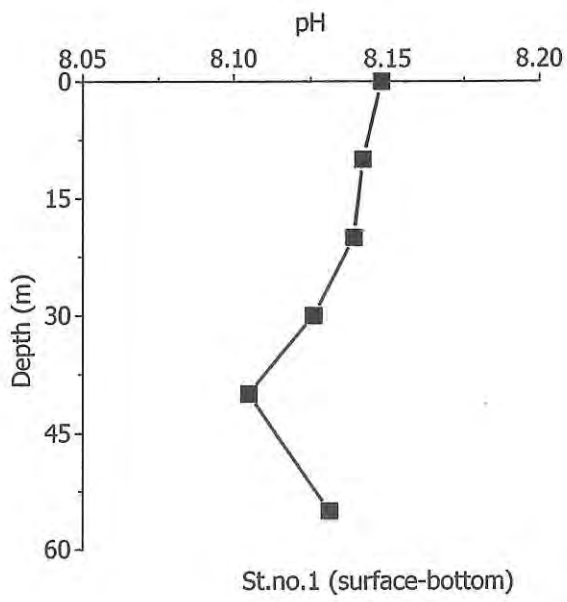




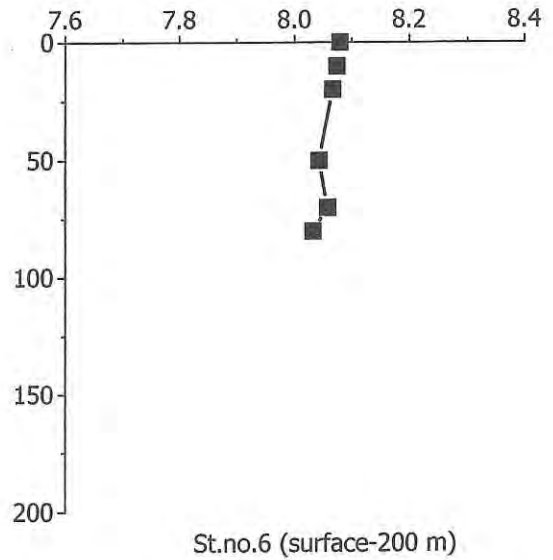
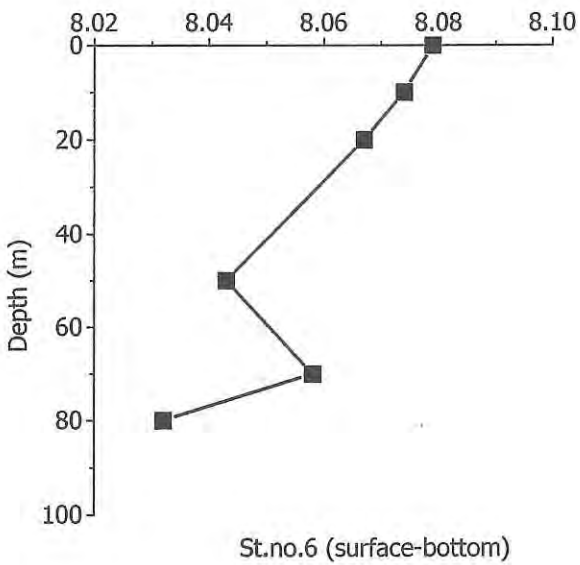
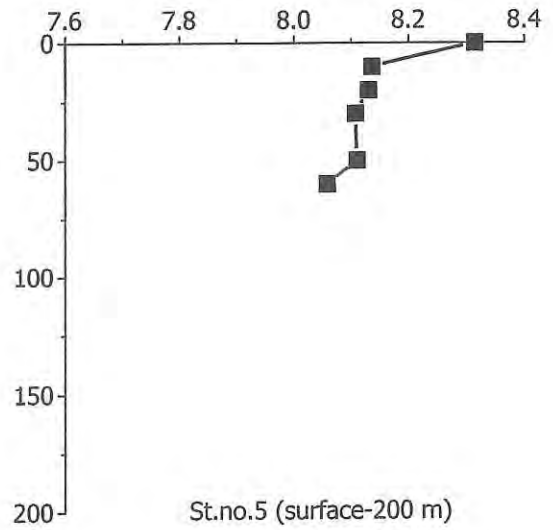
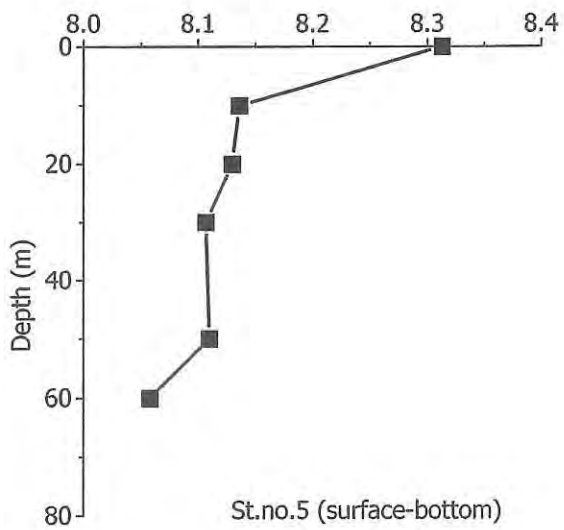
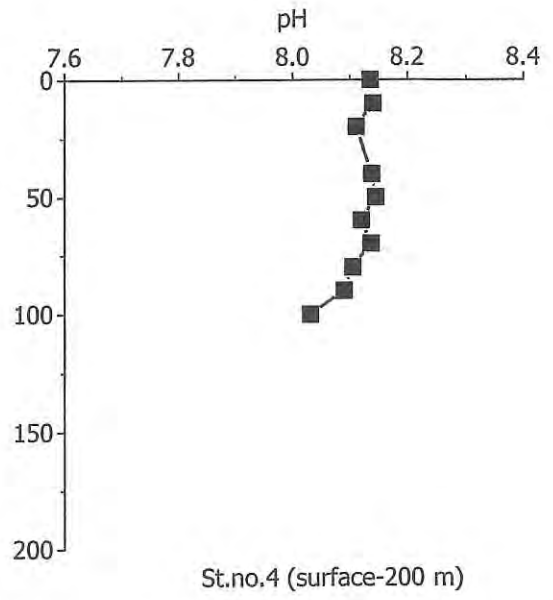
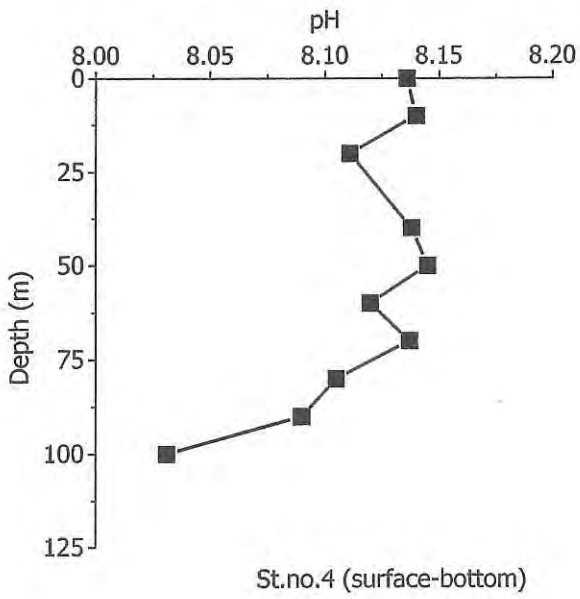


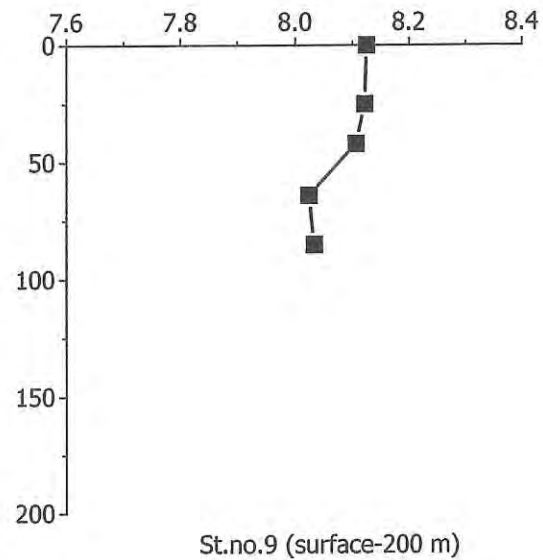
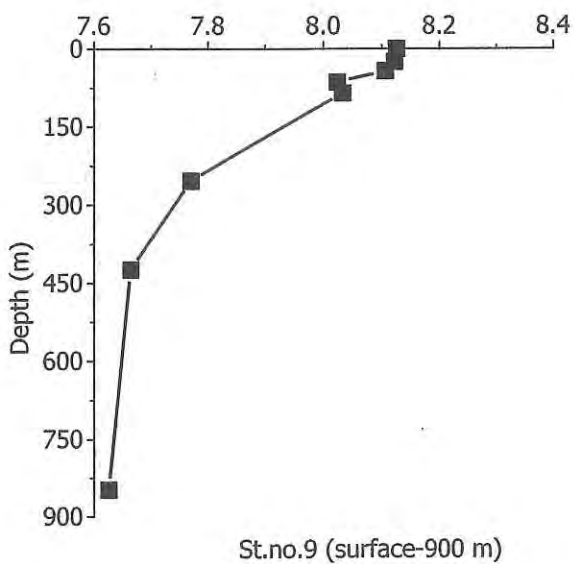
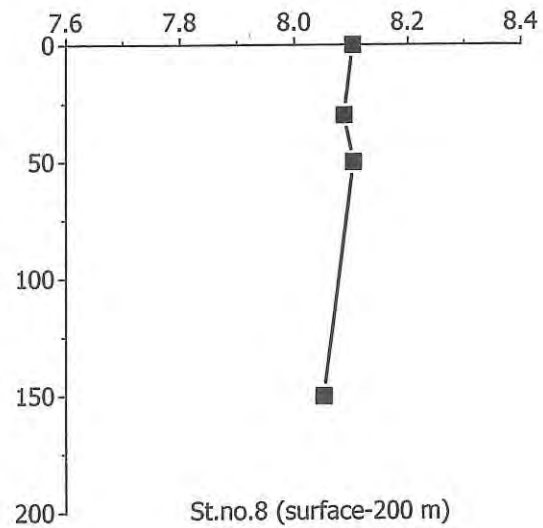
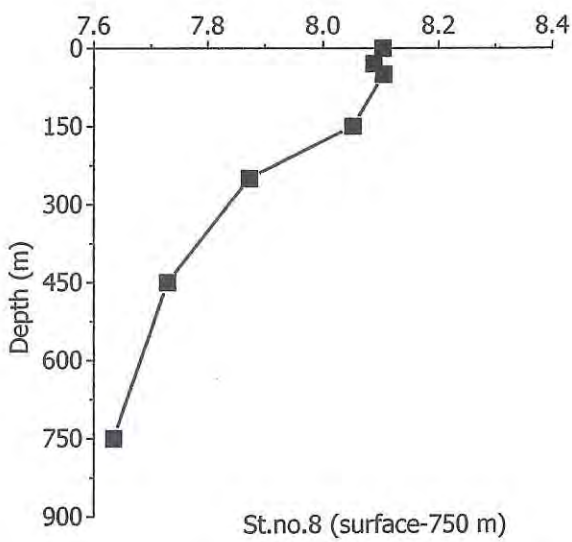
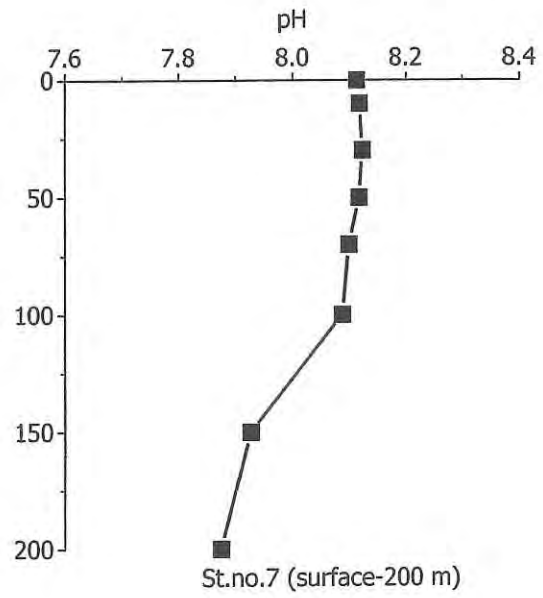
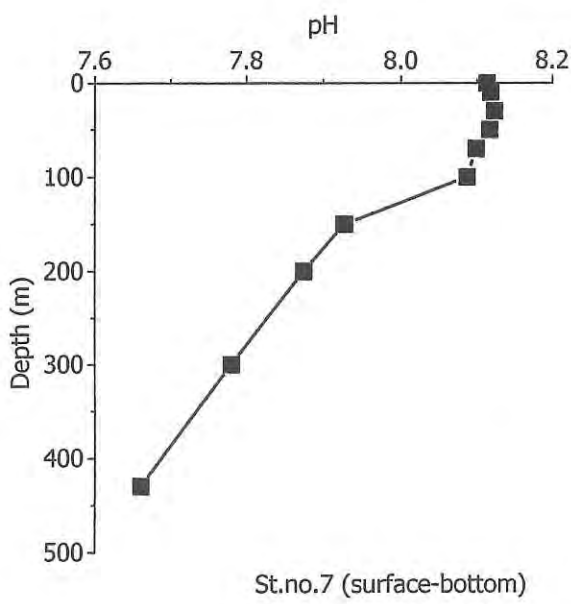


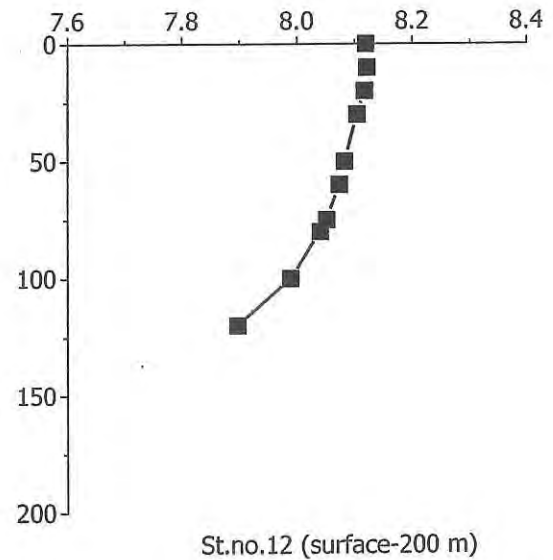
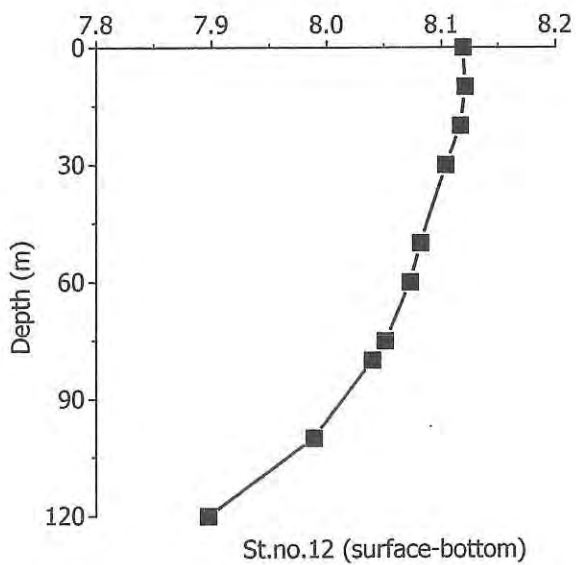
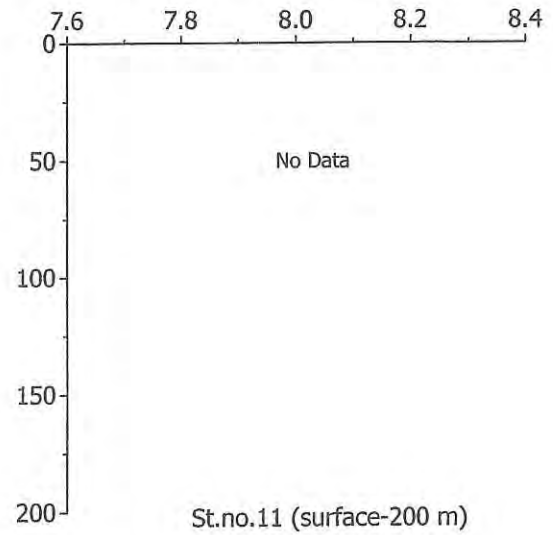
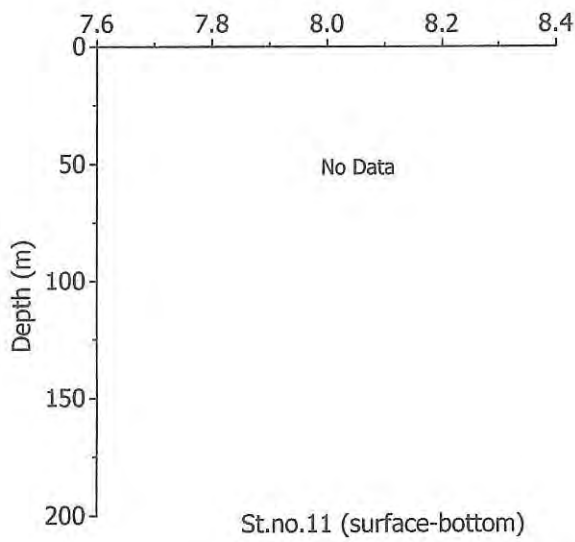
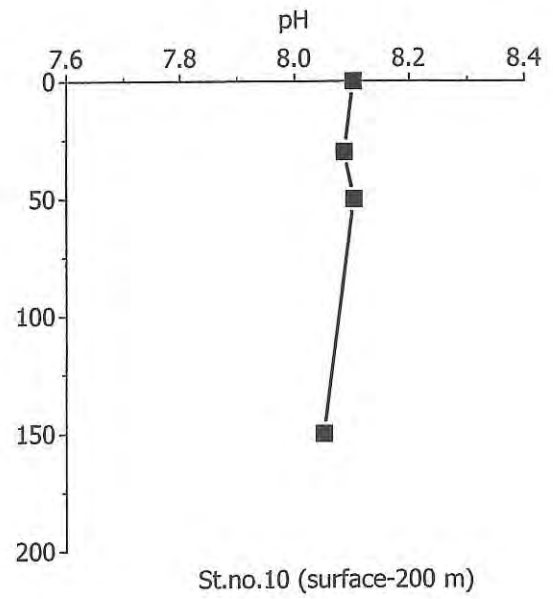
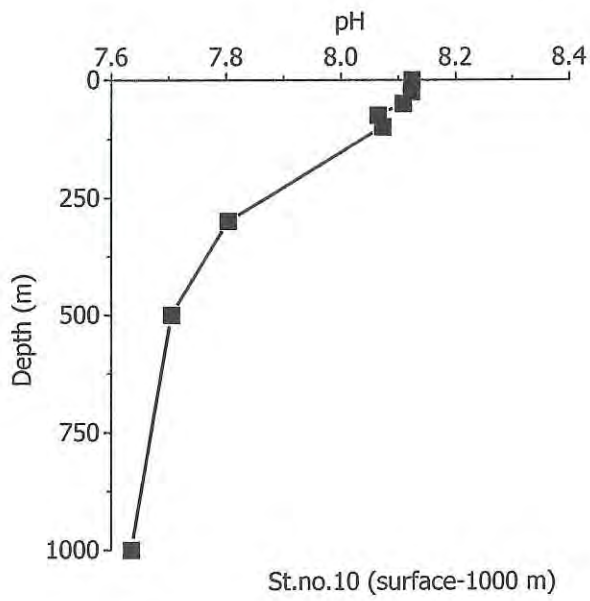
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Phase II : Waters of Sabah, Sarawak and Brunei Darussalam*



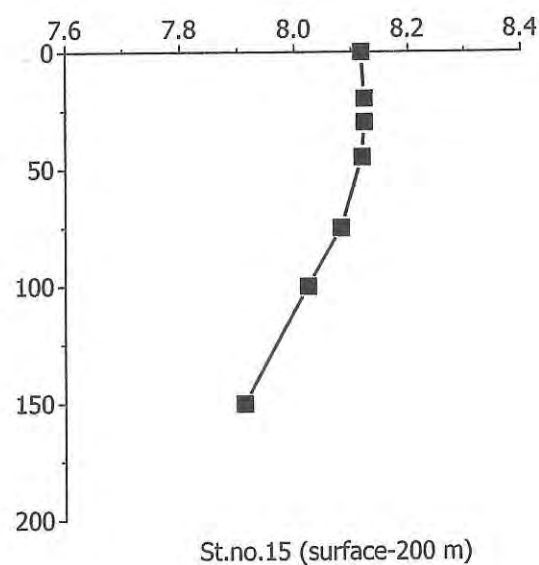
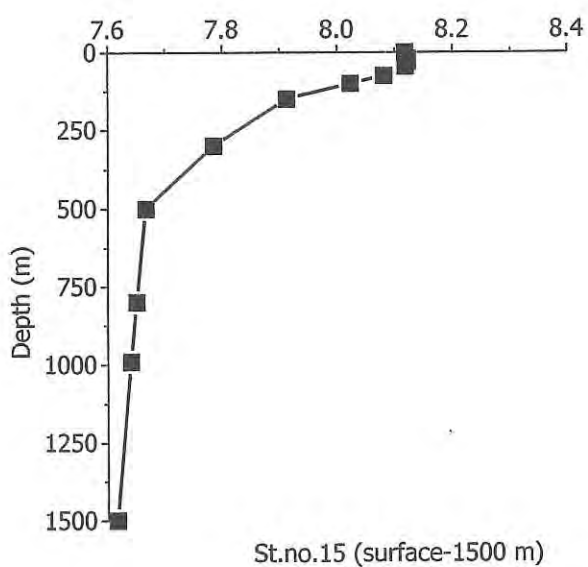
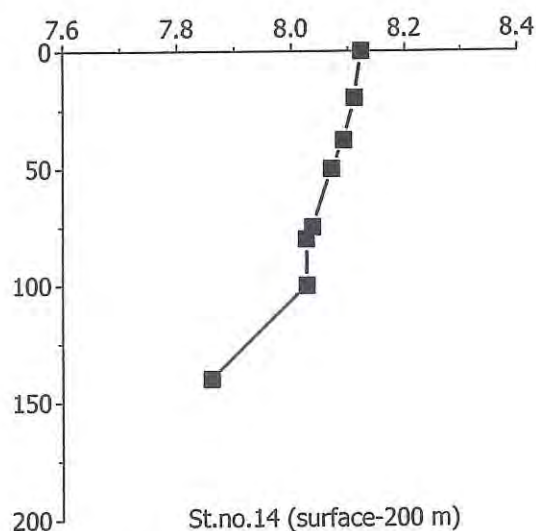
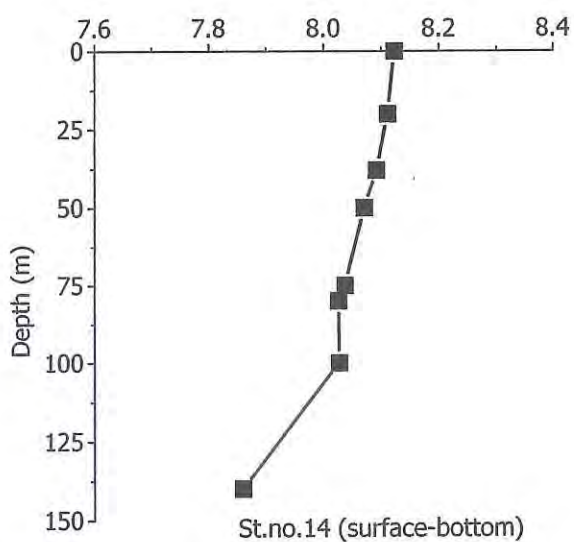
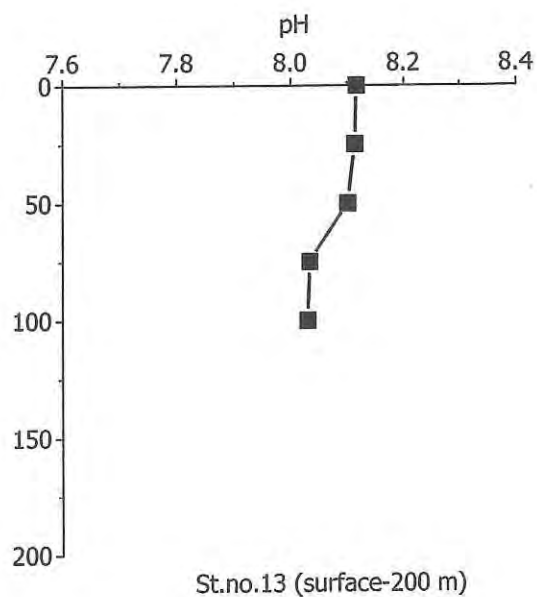
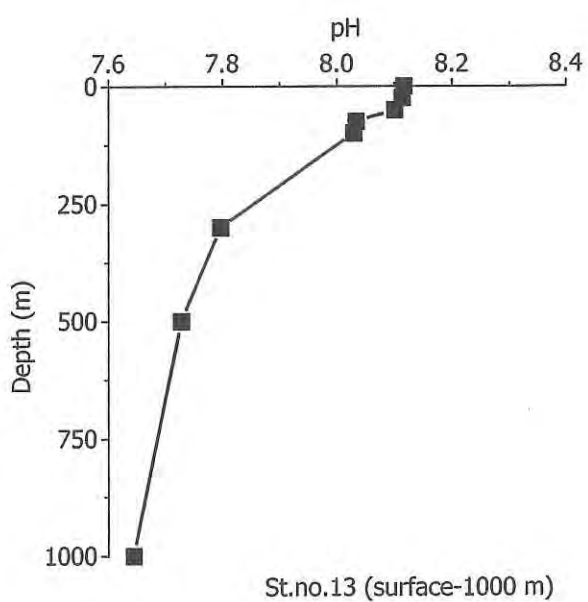


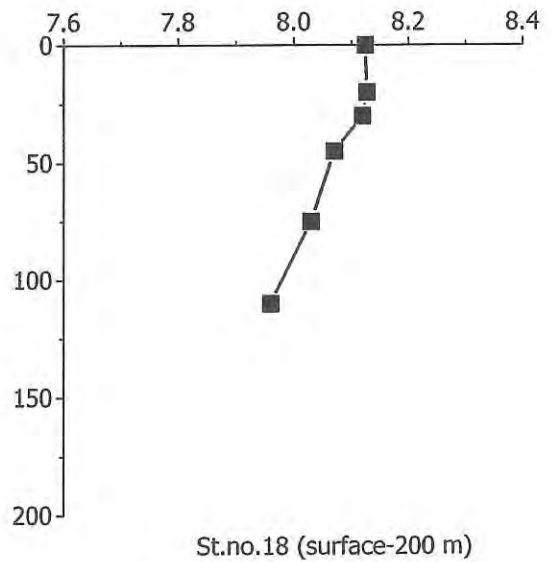
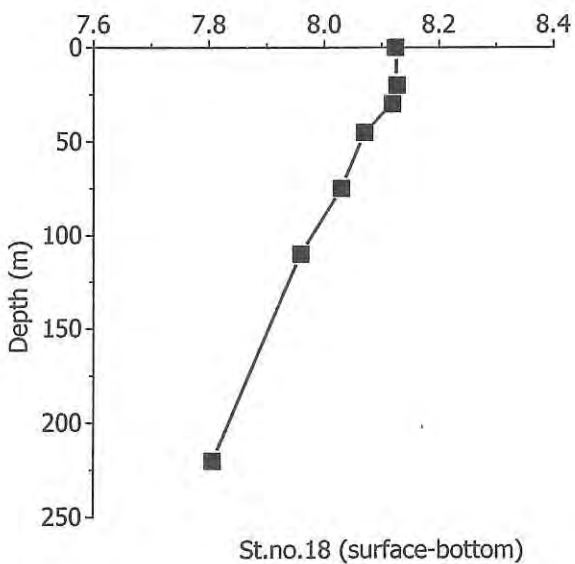
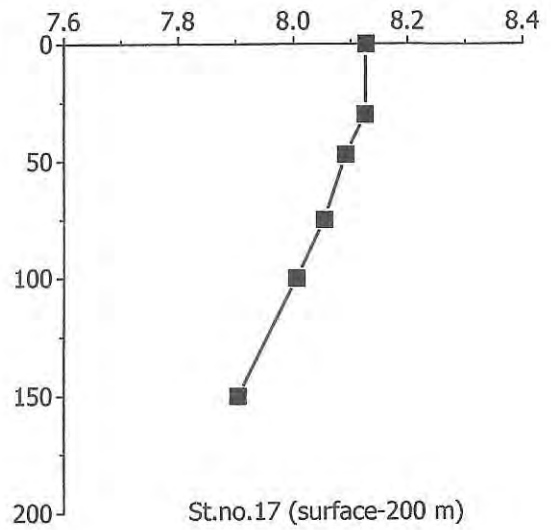
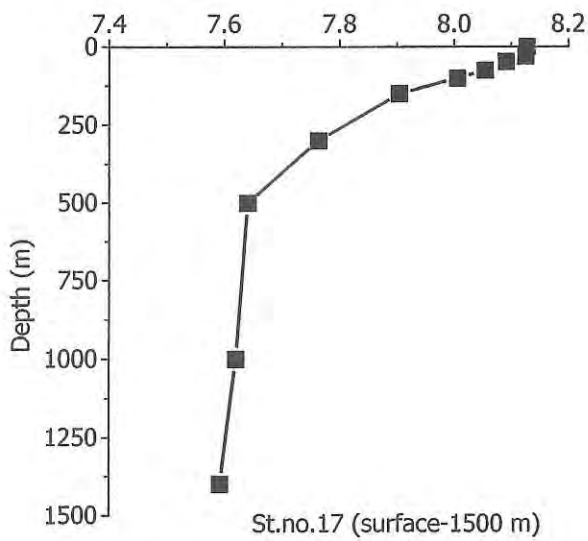
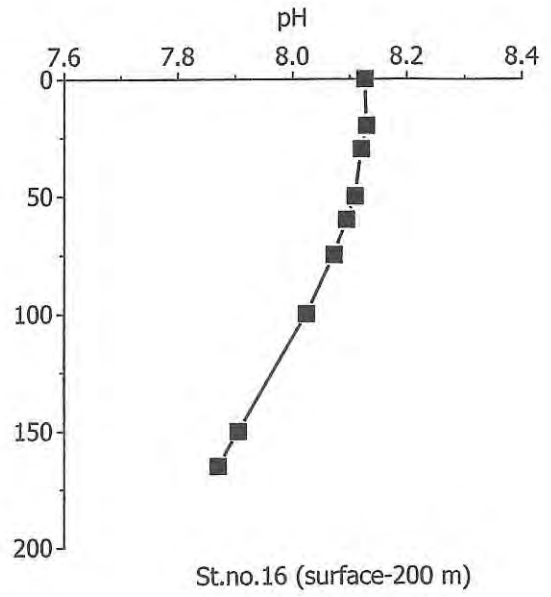
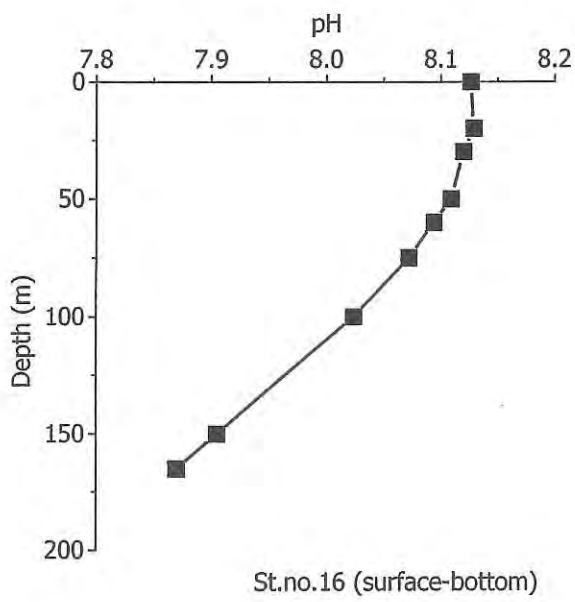


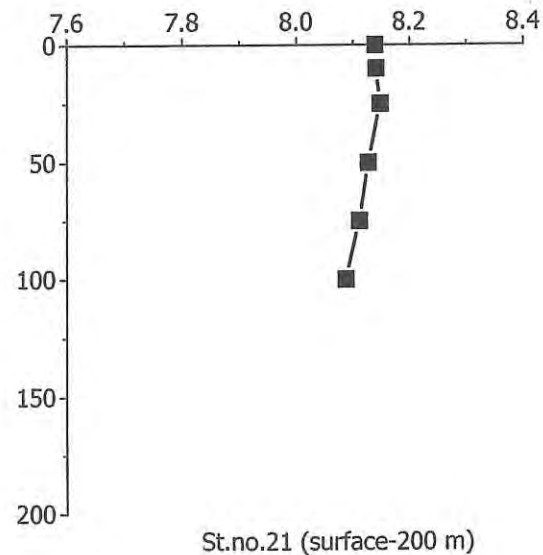
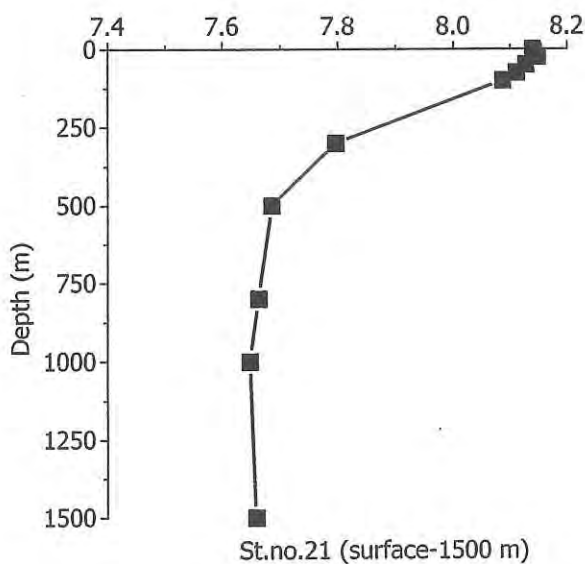
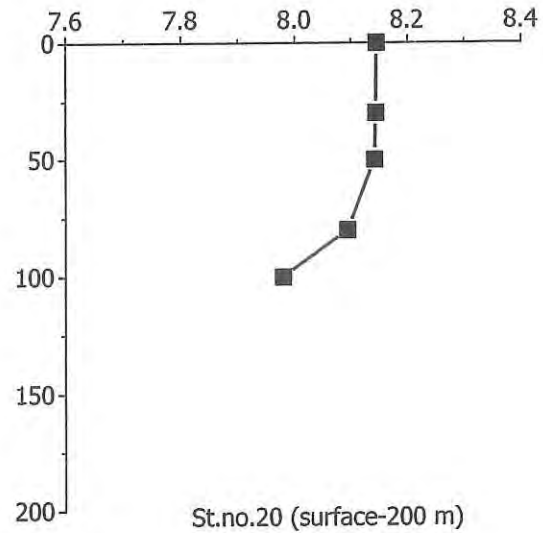
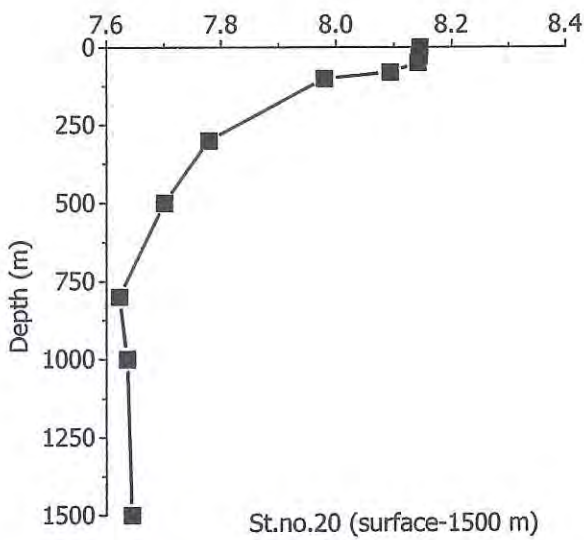
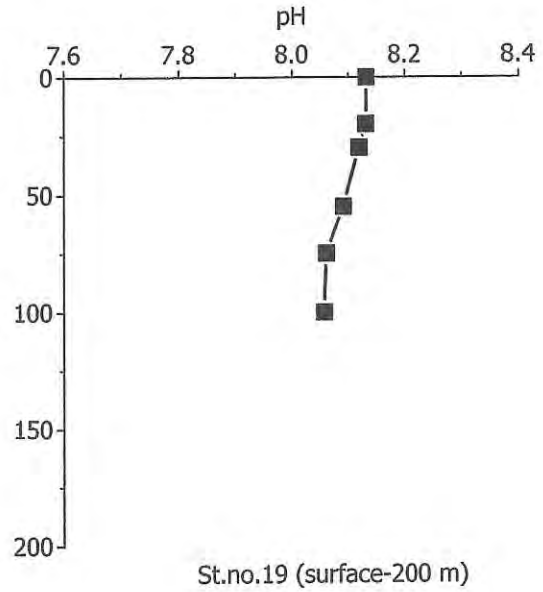
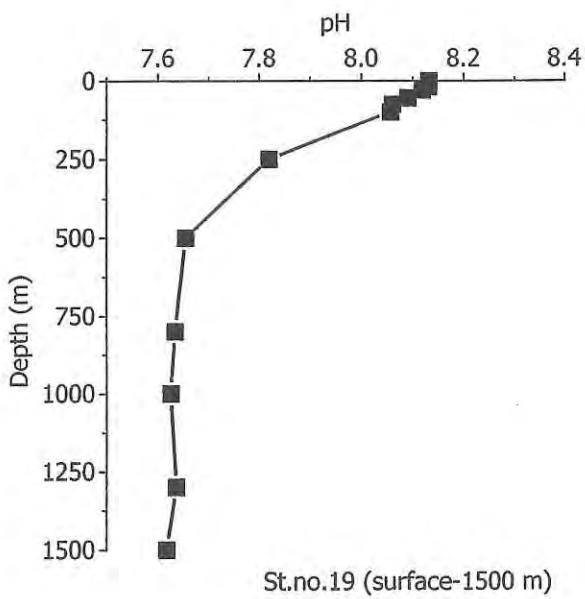


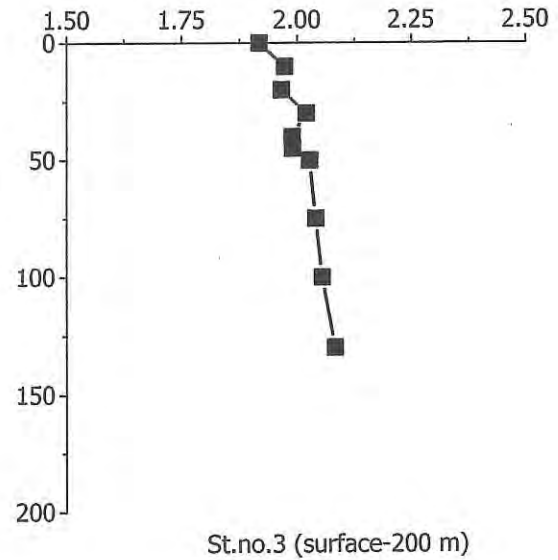
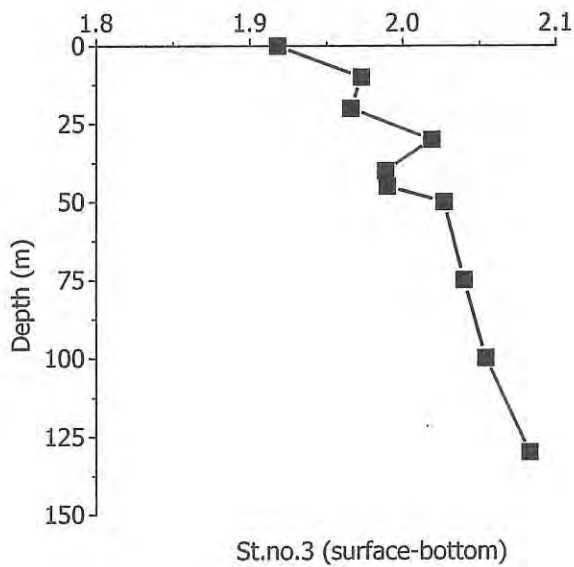
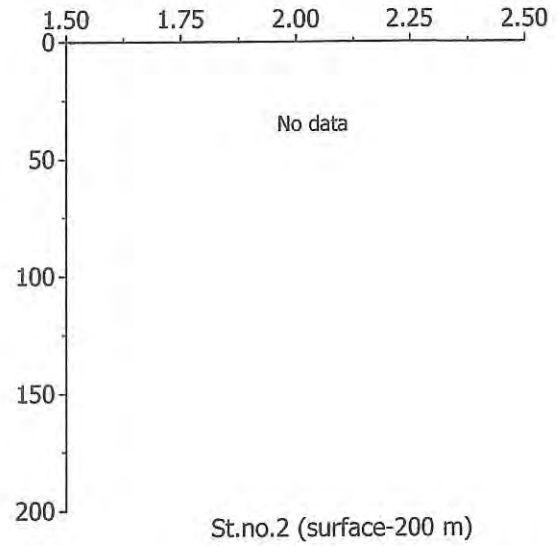
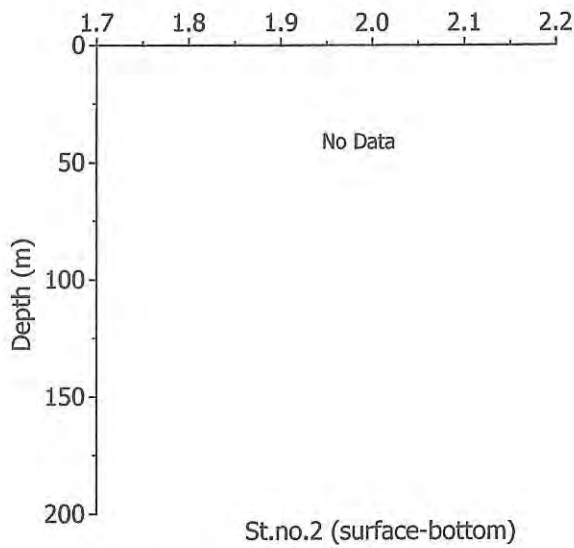
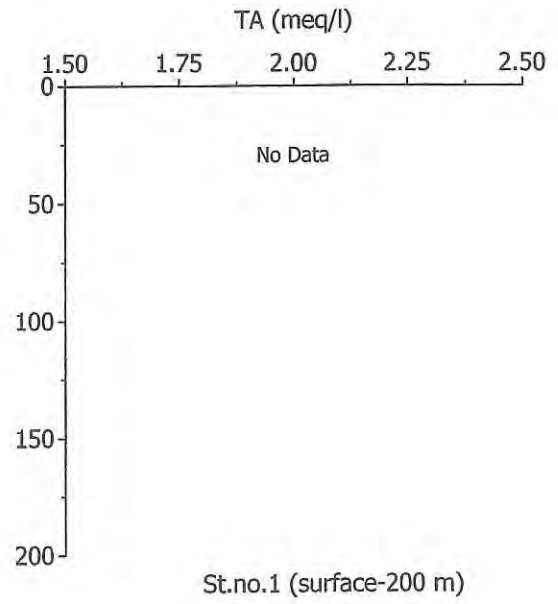
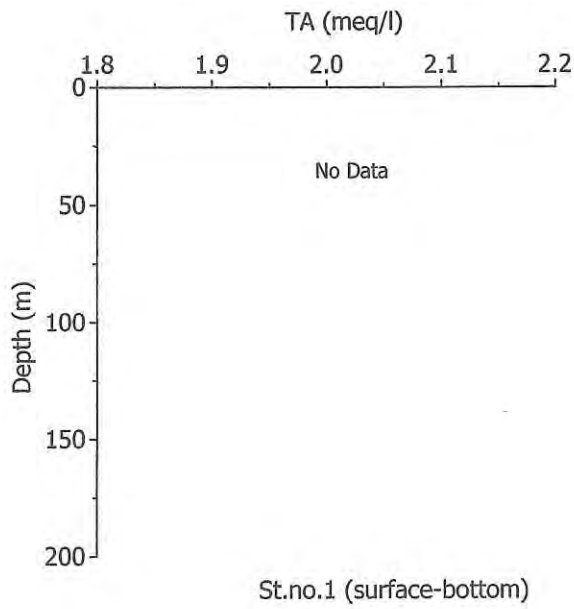


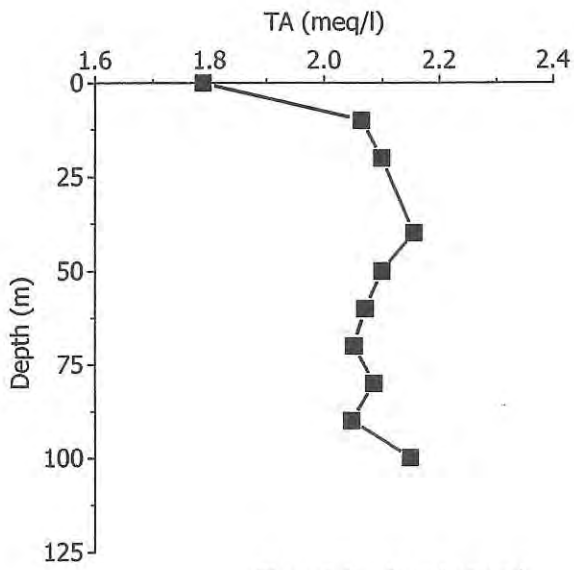
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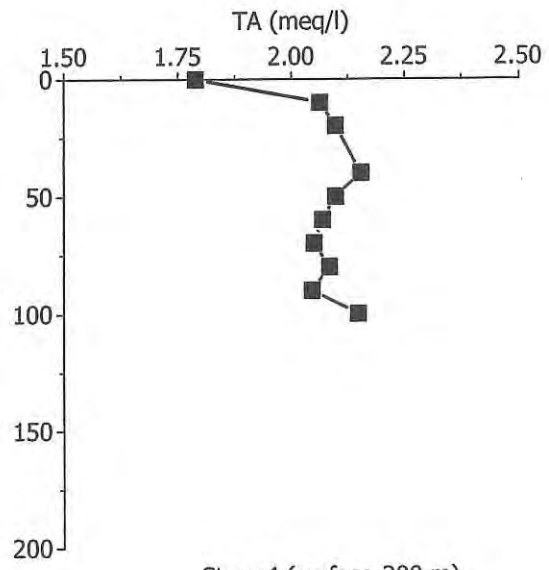




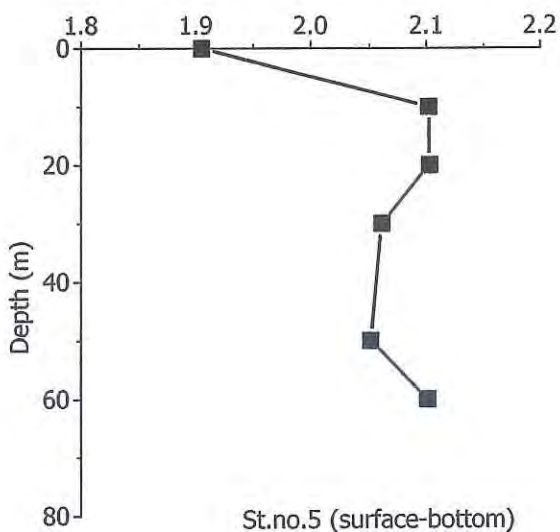




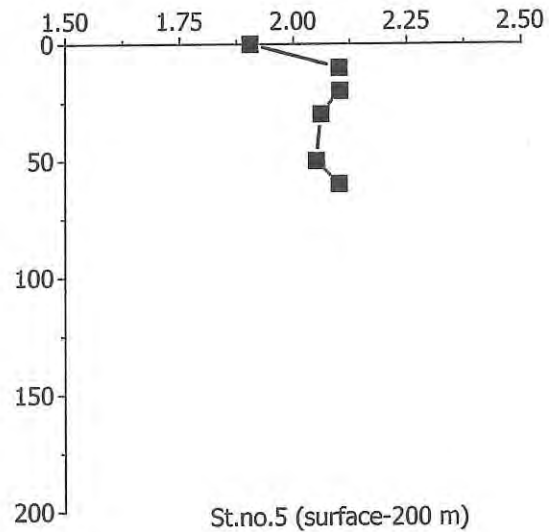
St.no.4 (surface-bottom)



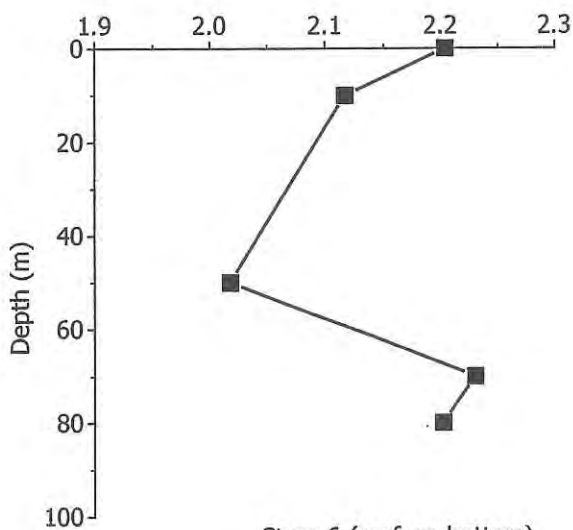
St.no.4 (surface-200 m)



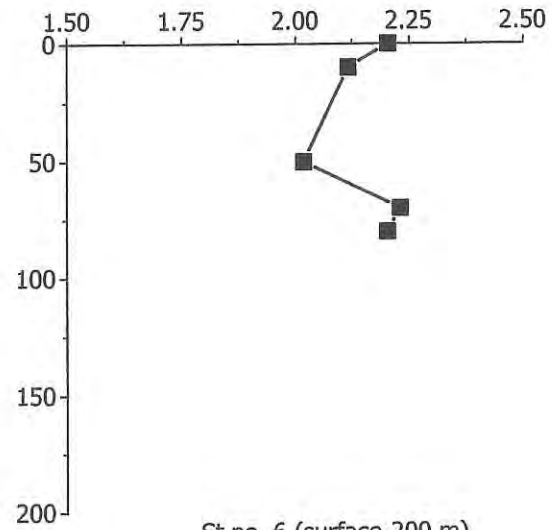
St.no.5 (surface-bottom)



St.no.5 (surface-200 m)

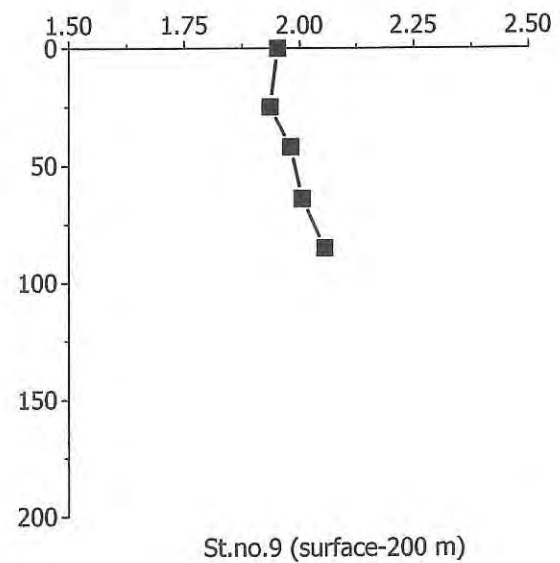
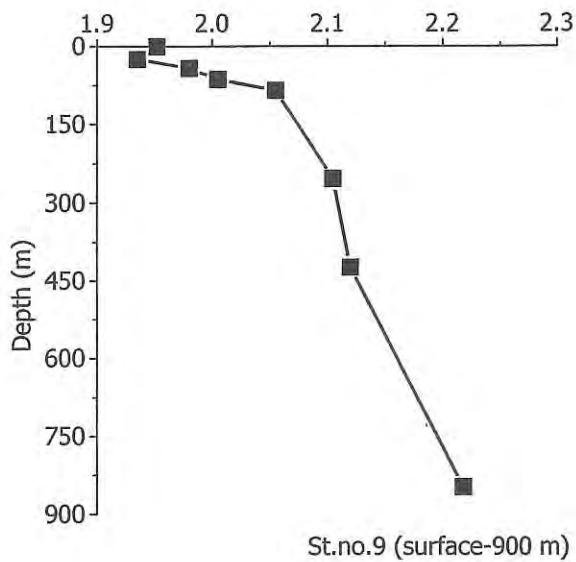
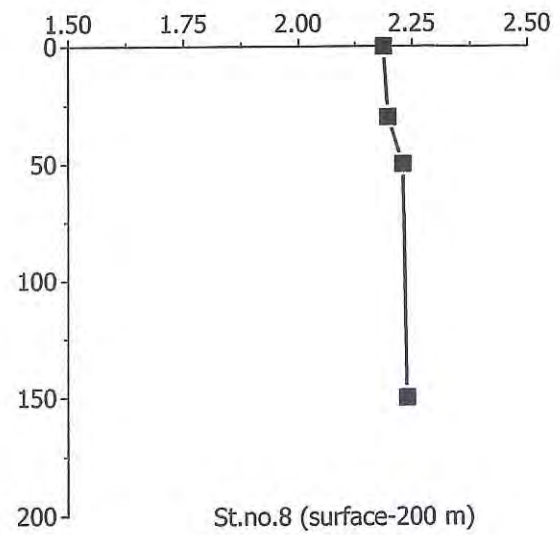
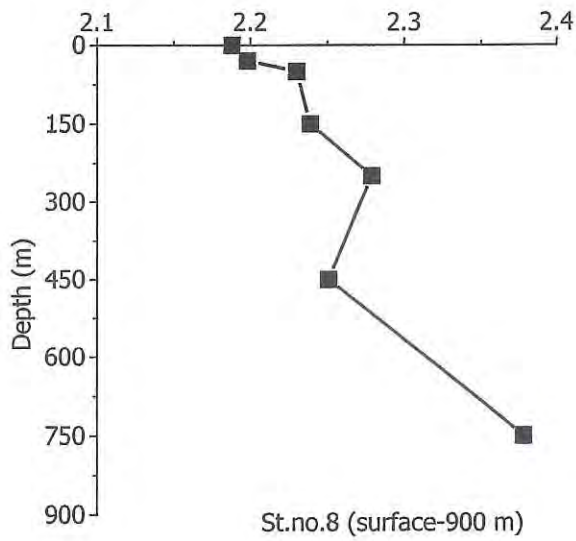
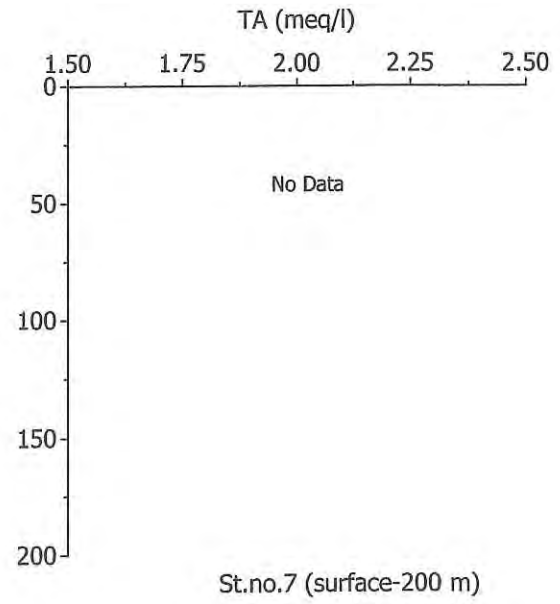
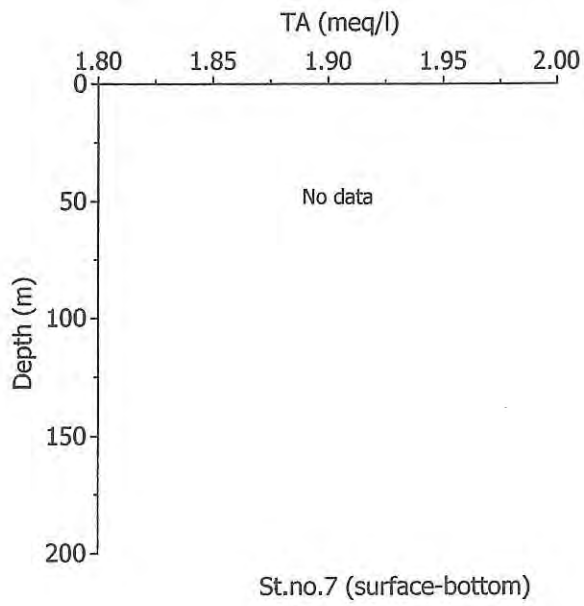


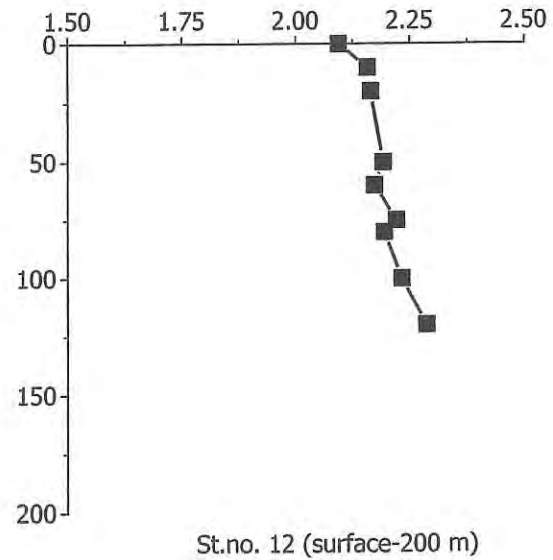
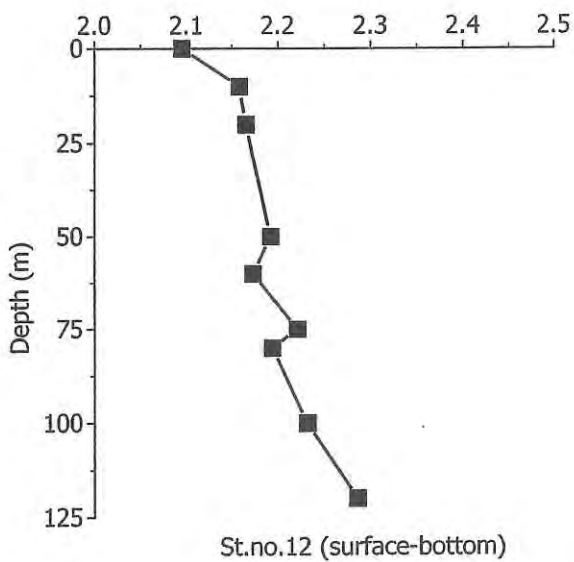
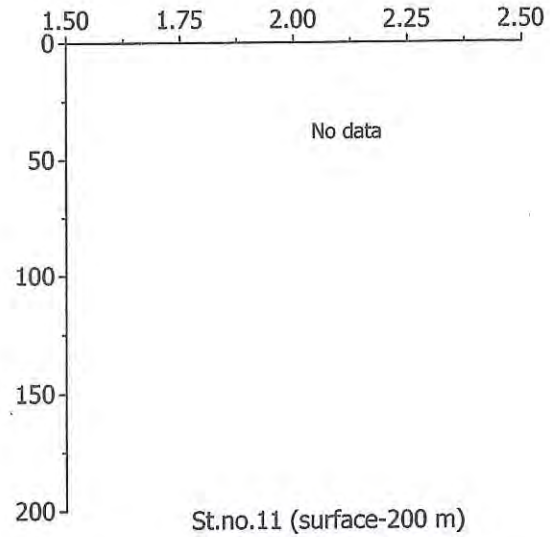
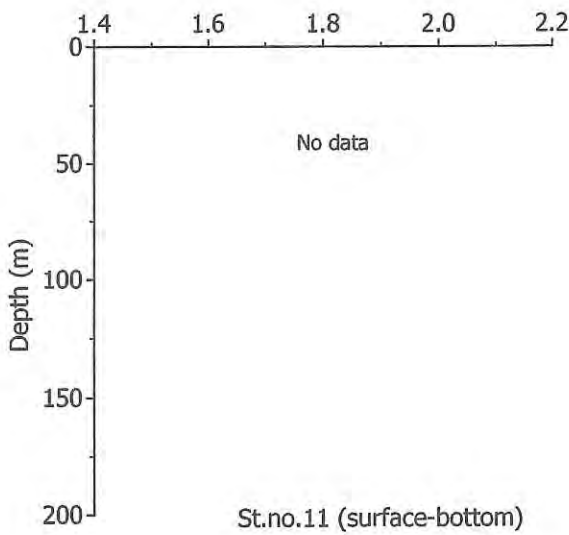
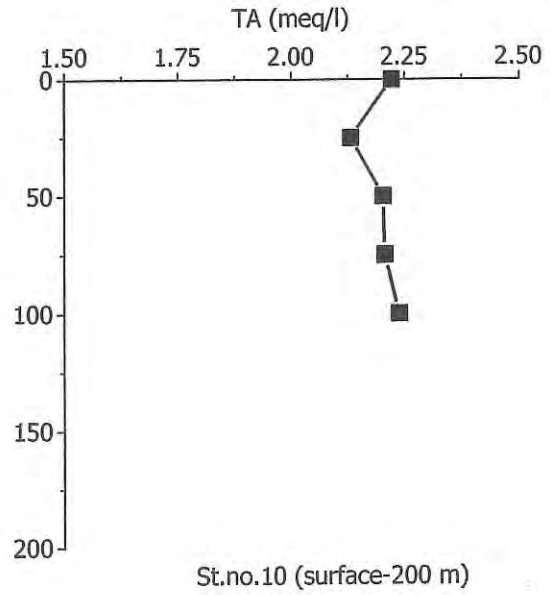
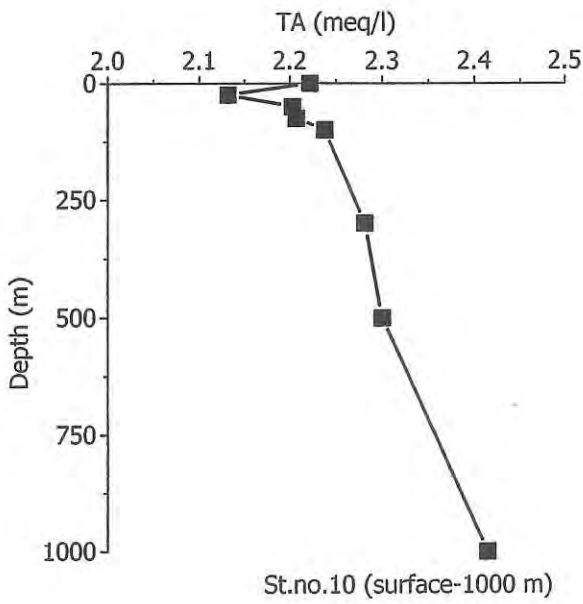
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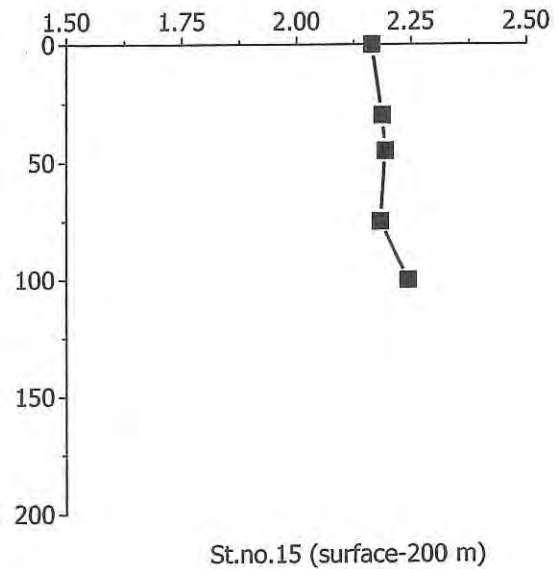
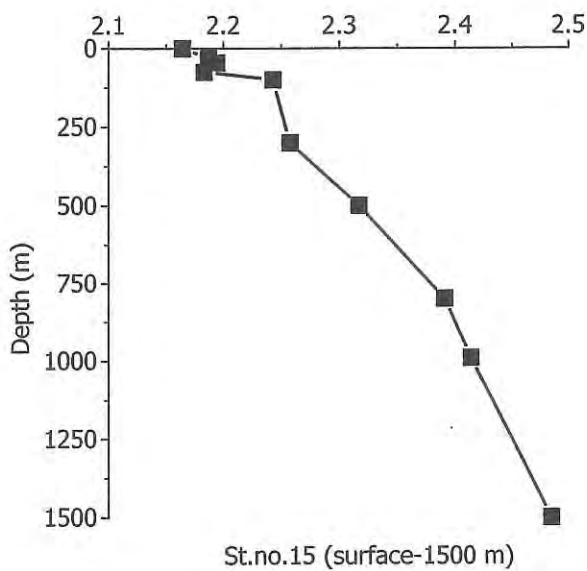
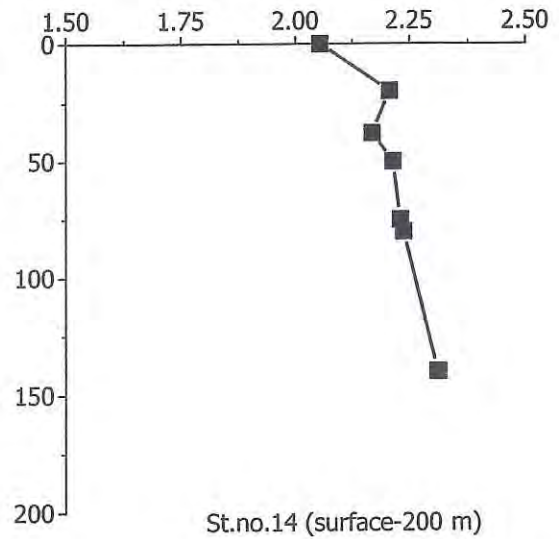
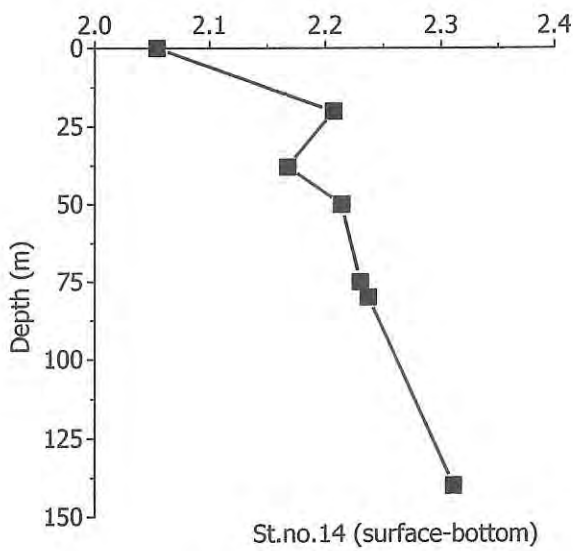
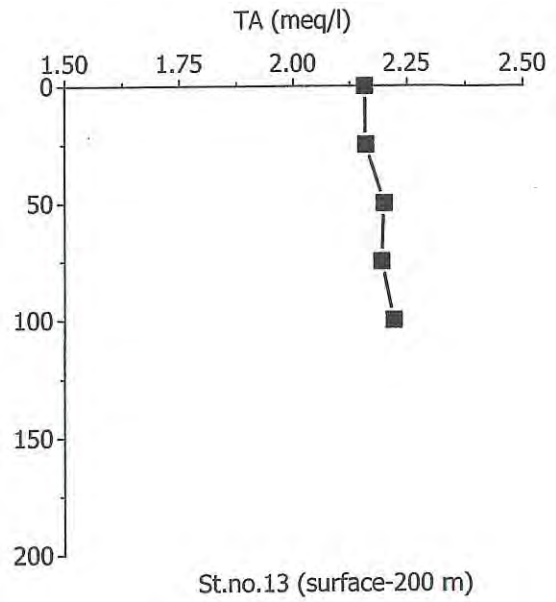
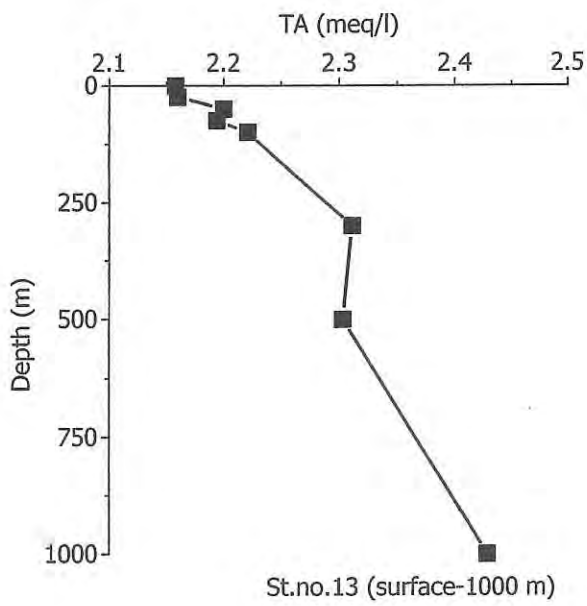


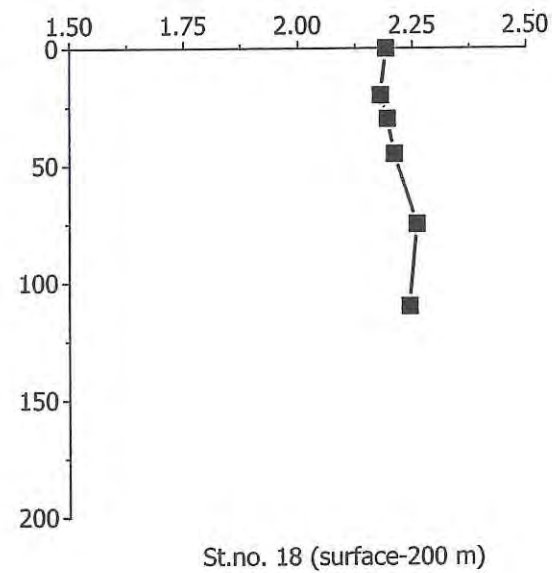
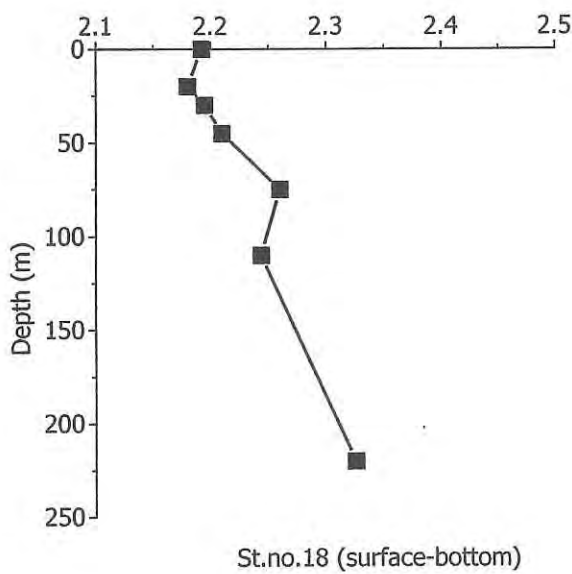
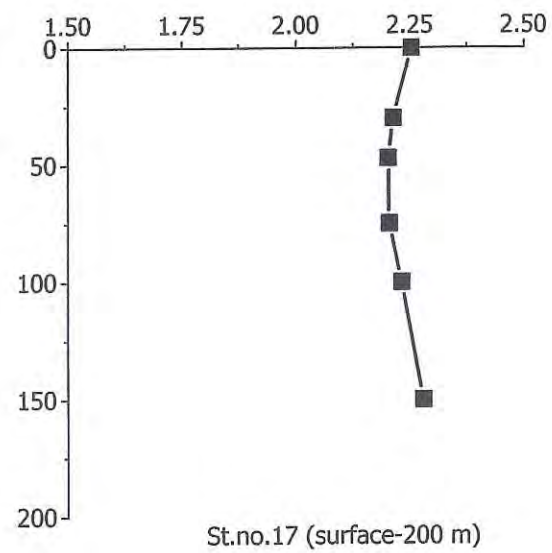
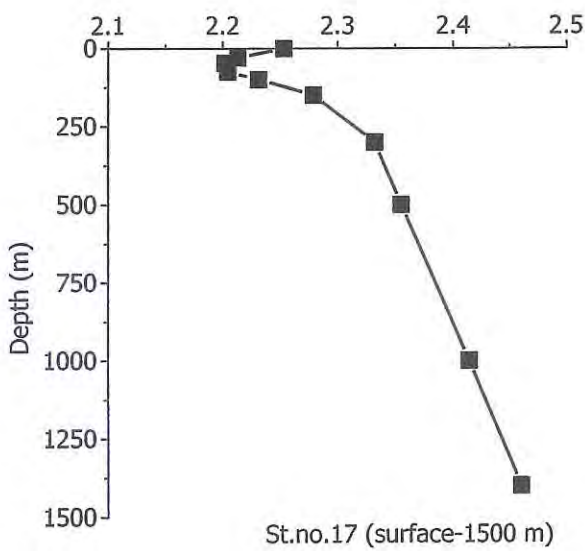
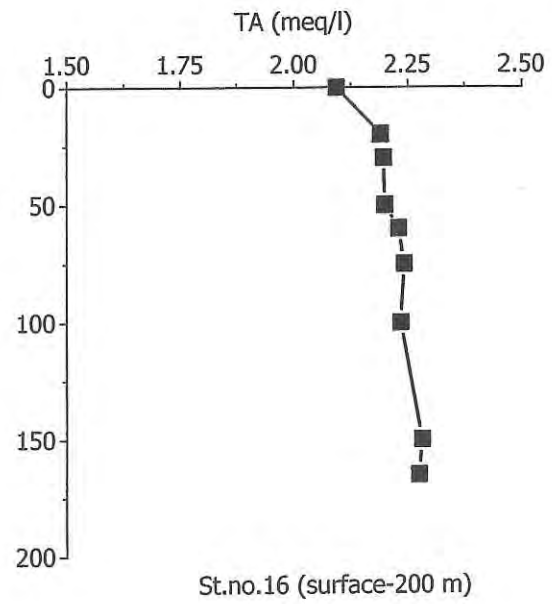
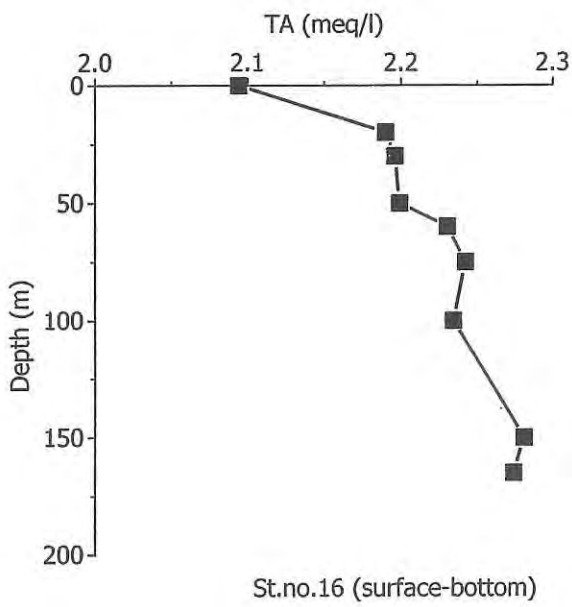
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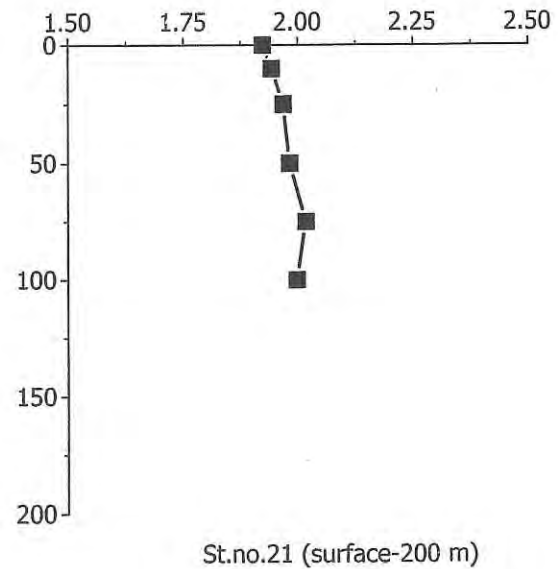
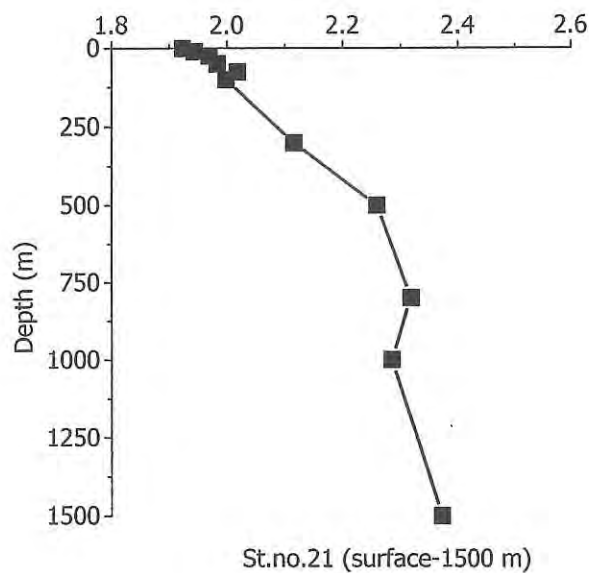
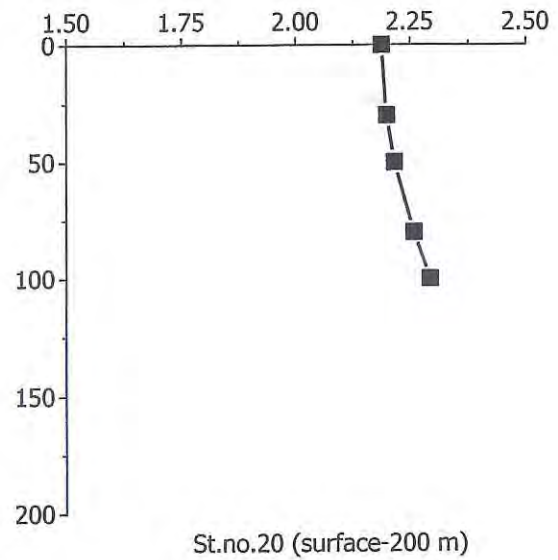
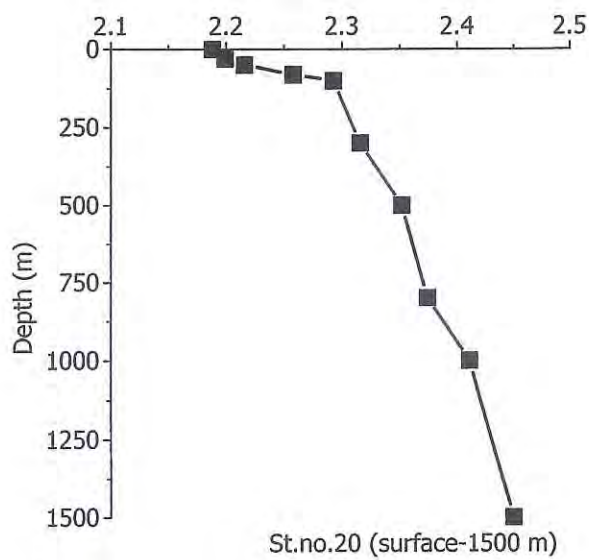
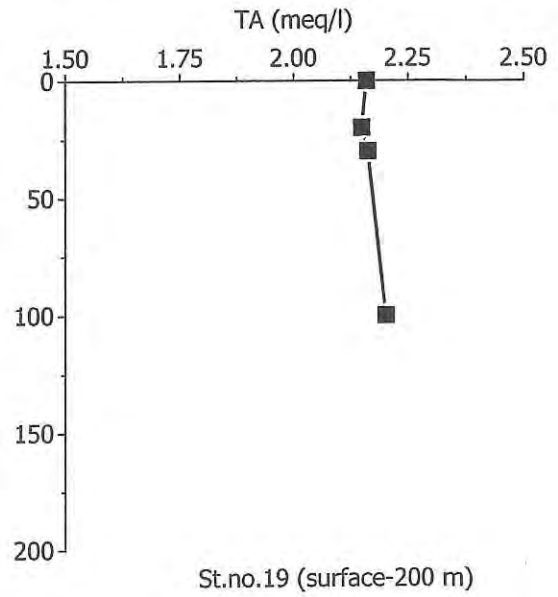
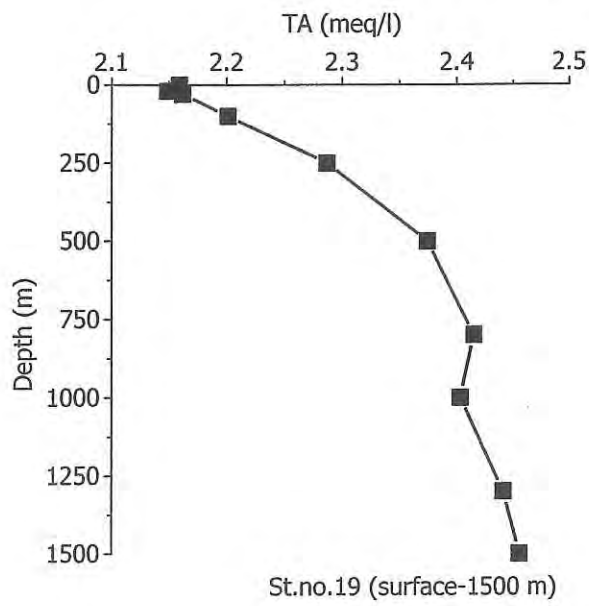


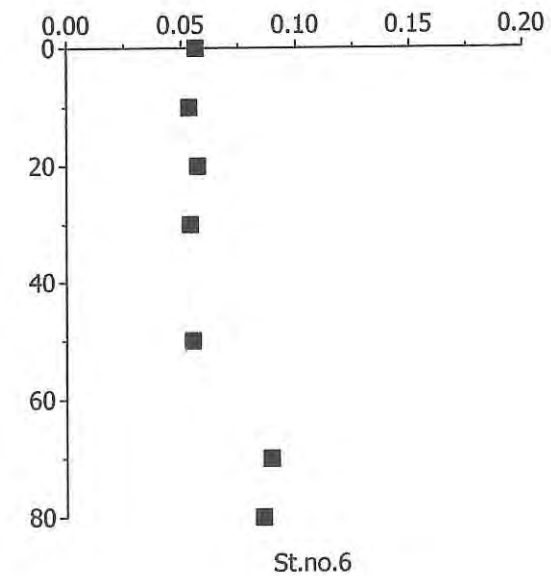
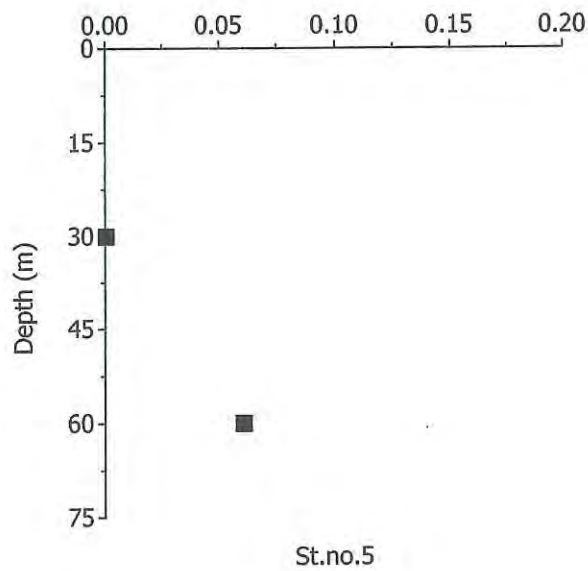
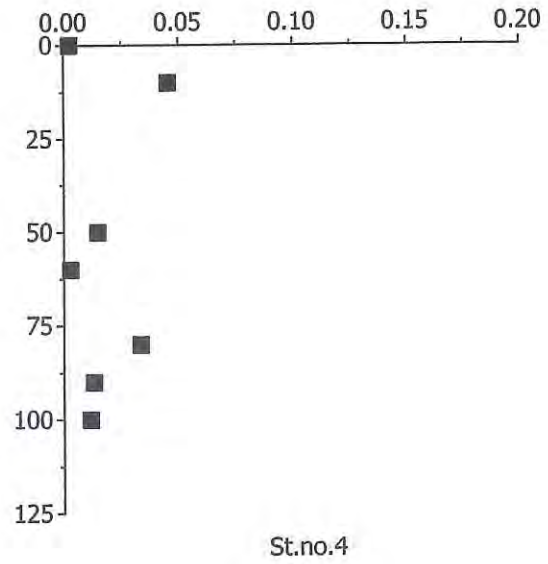
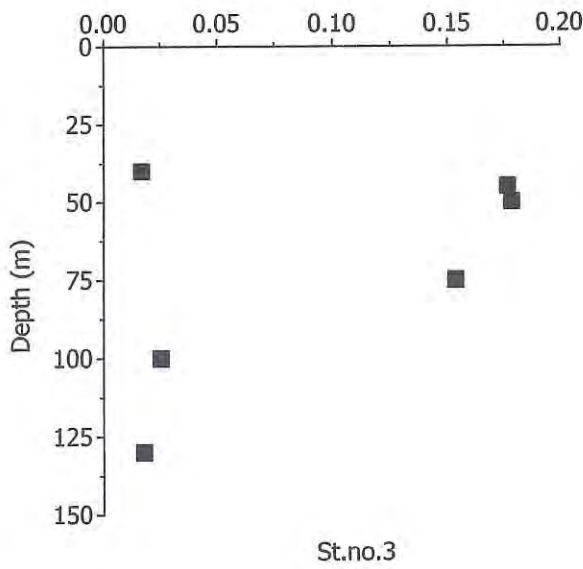
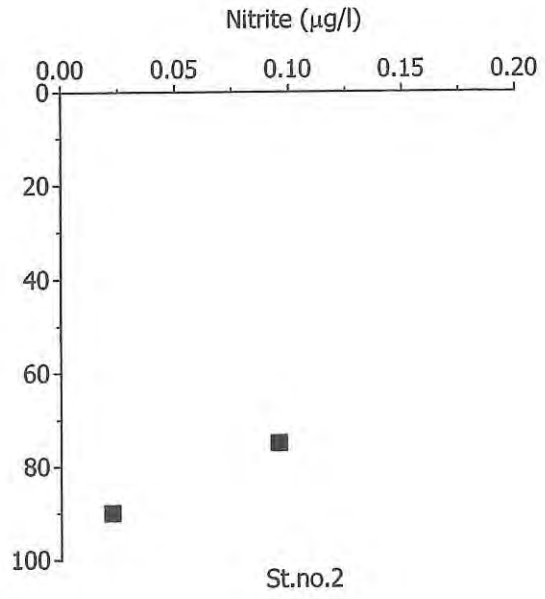
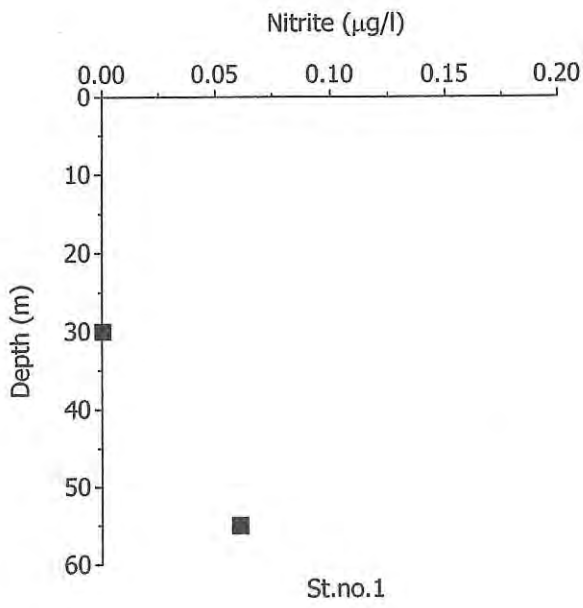


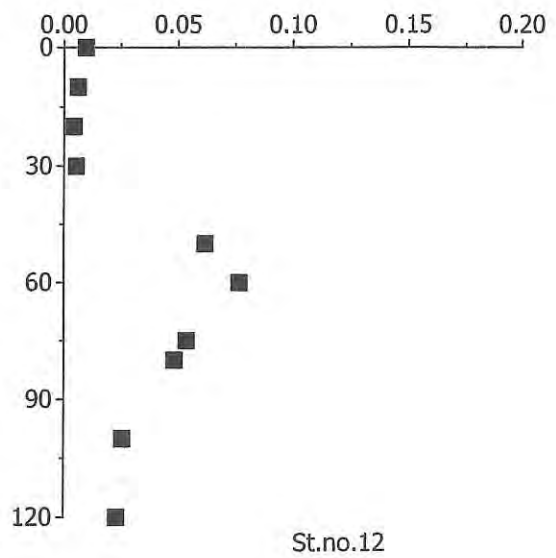
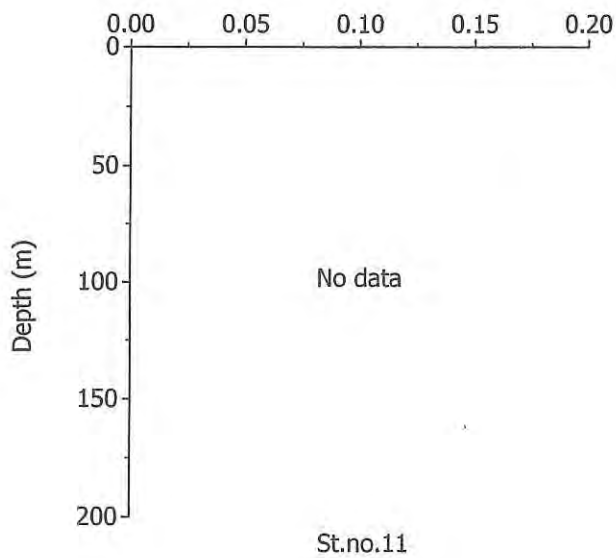
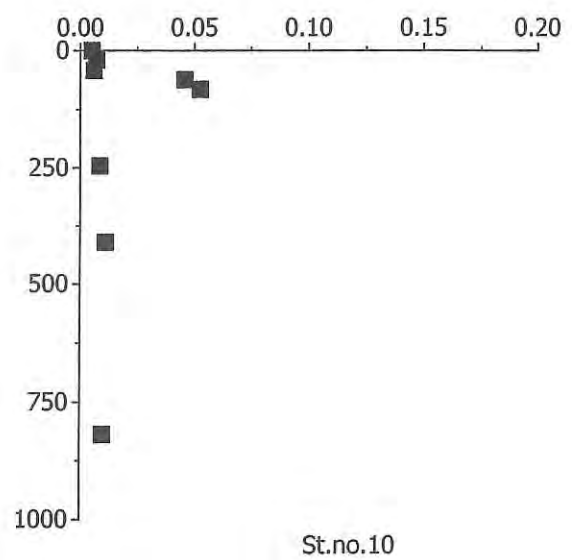
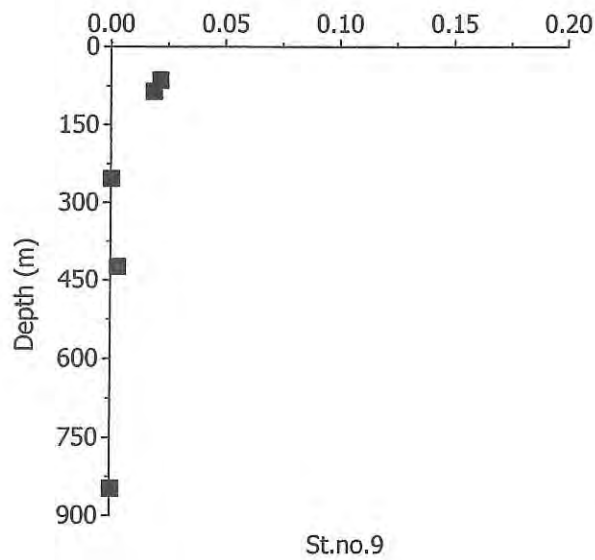
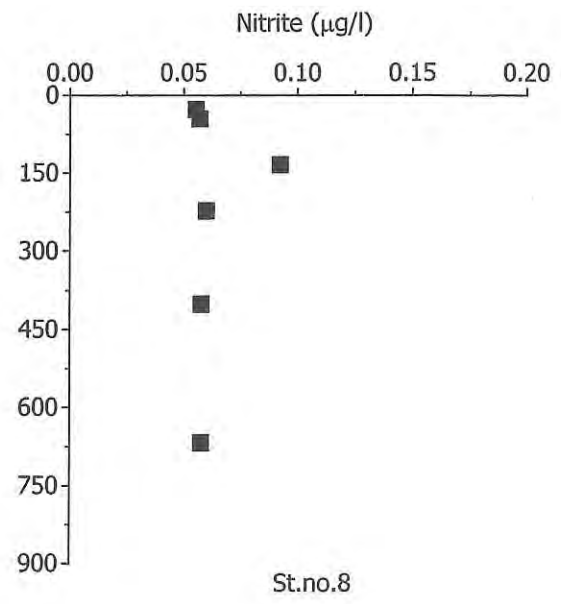
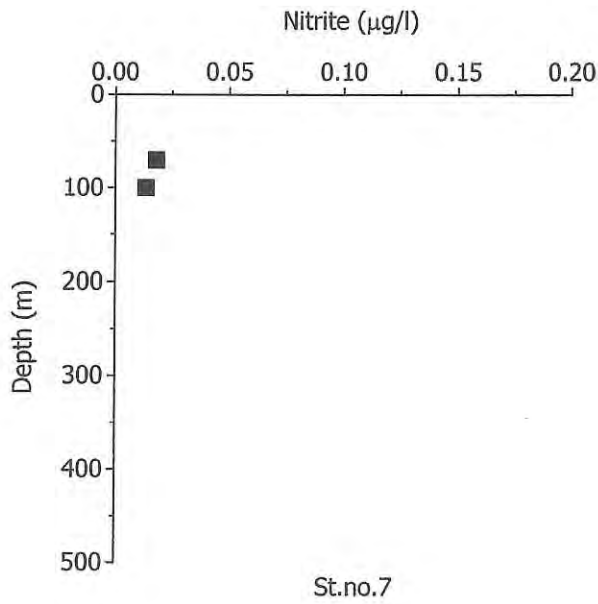


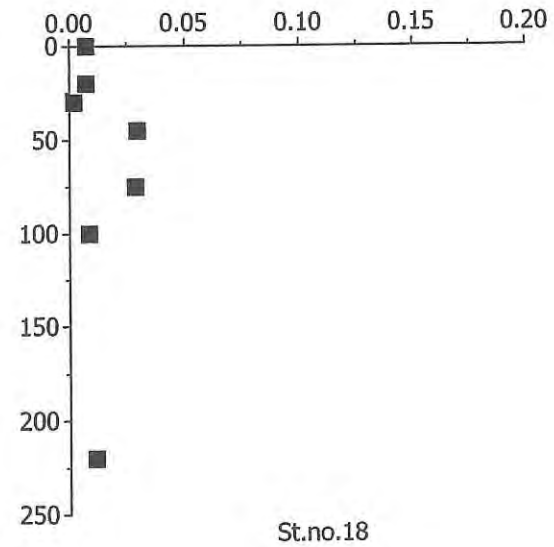
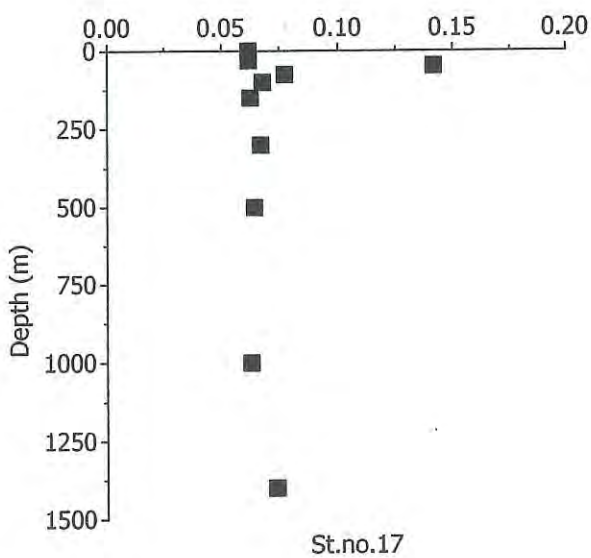
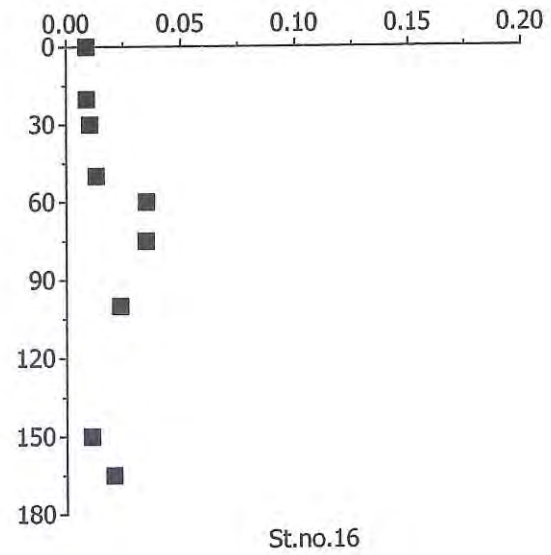
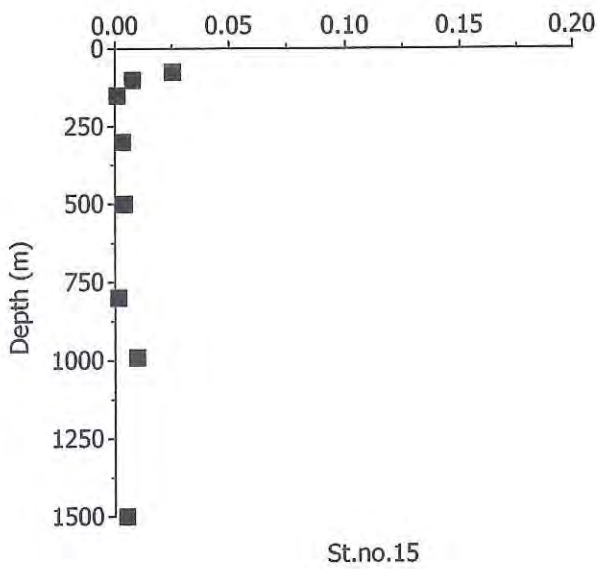
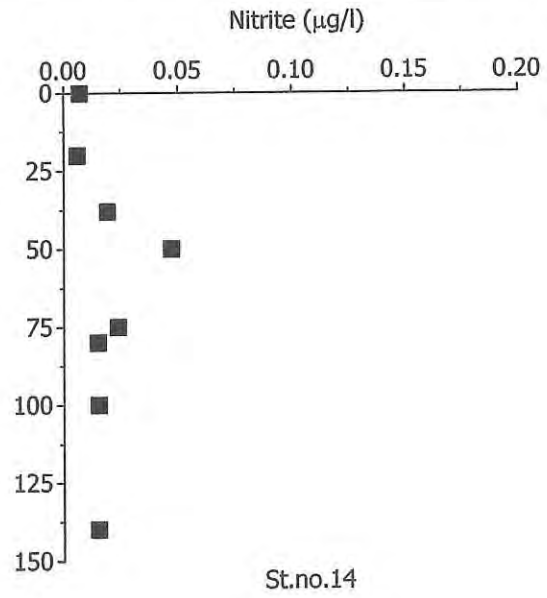
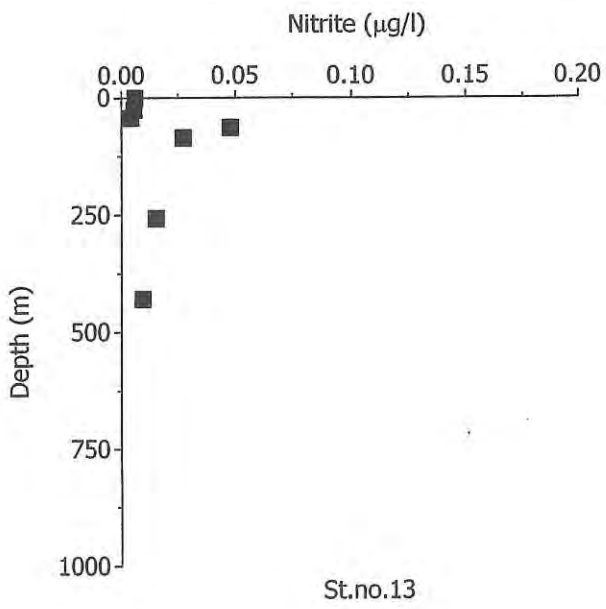




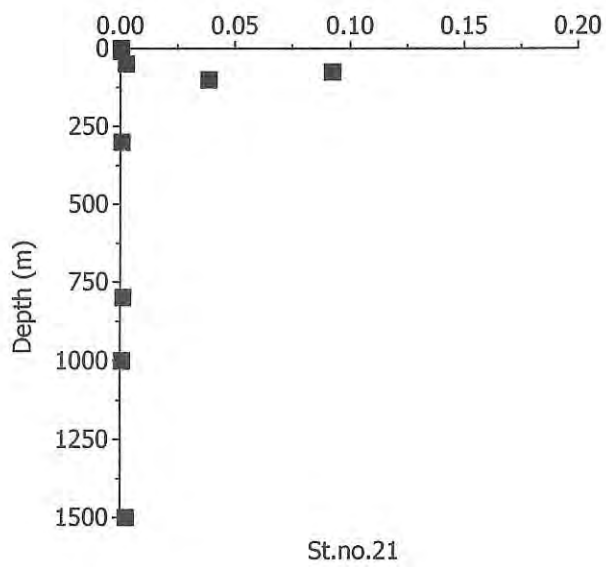
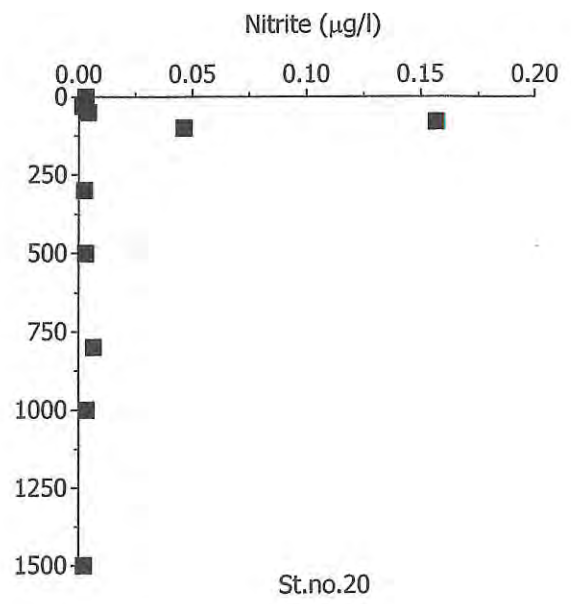
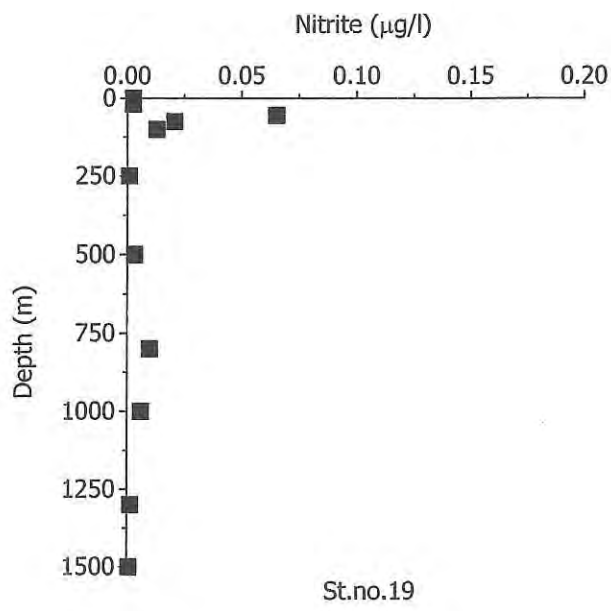




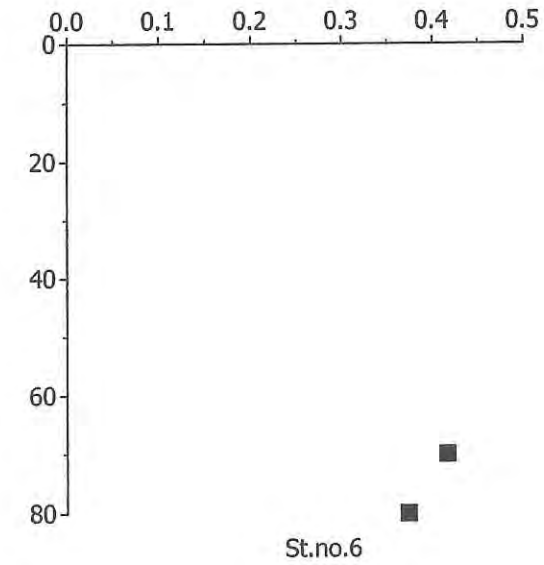
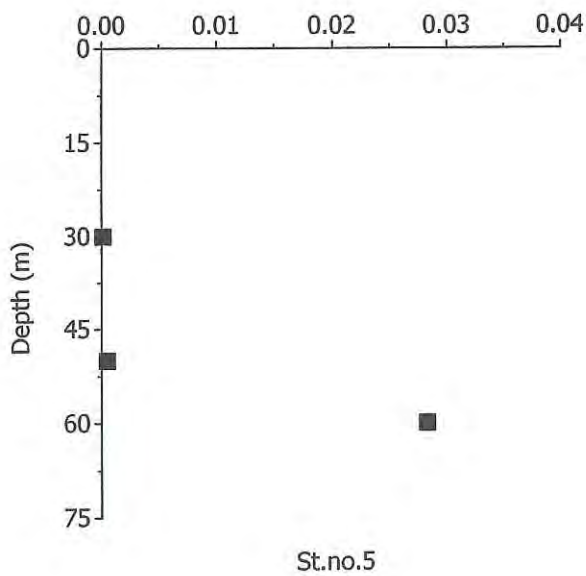
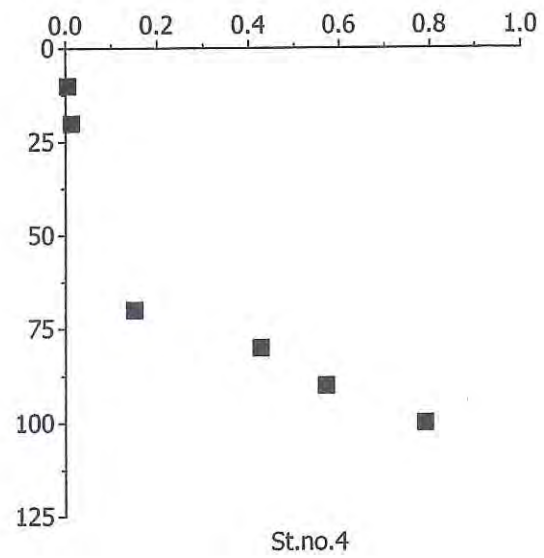
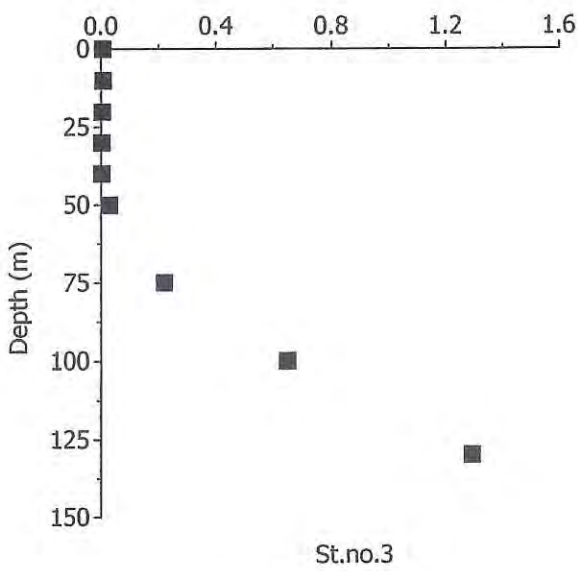
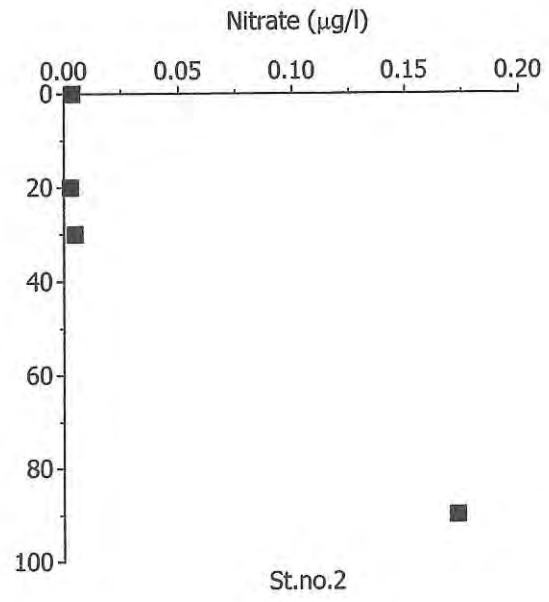
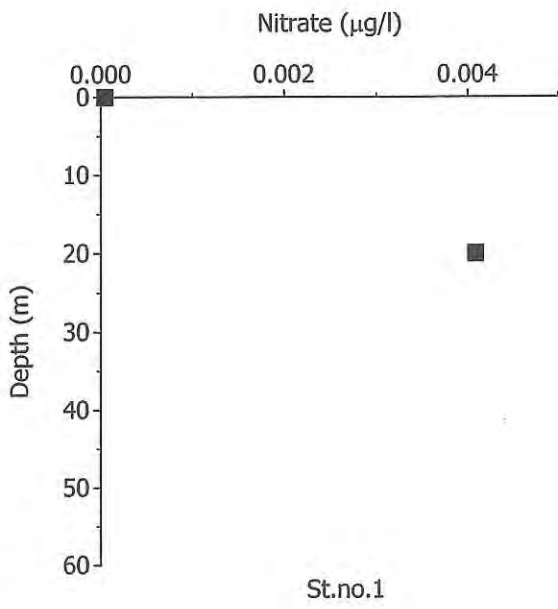


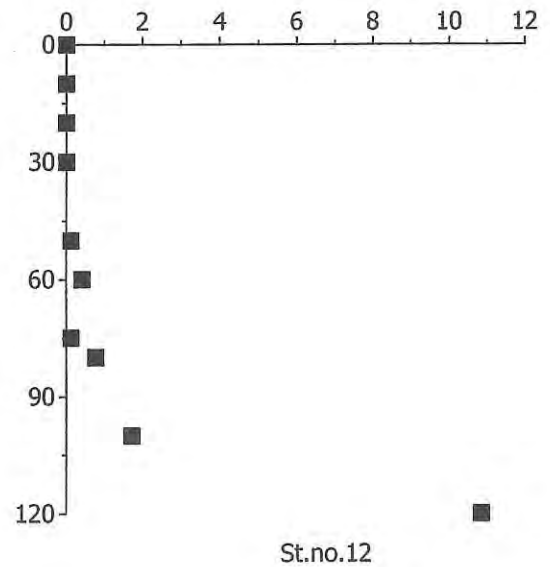
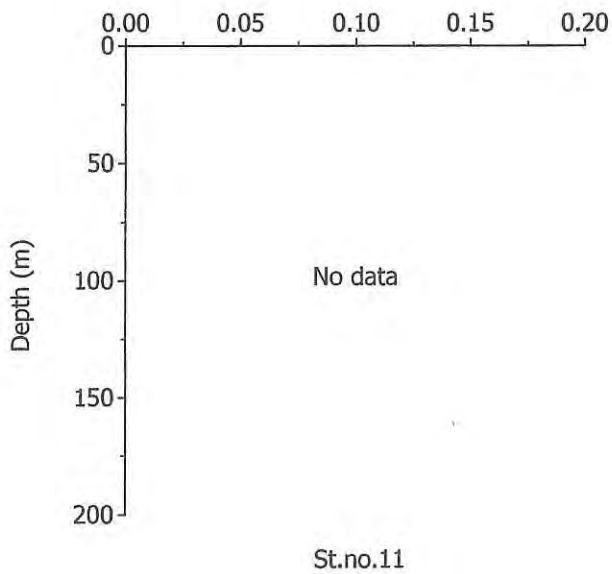
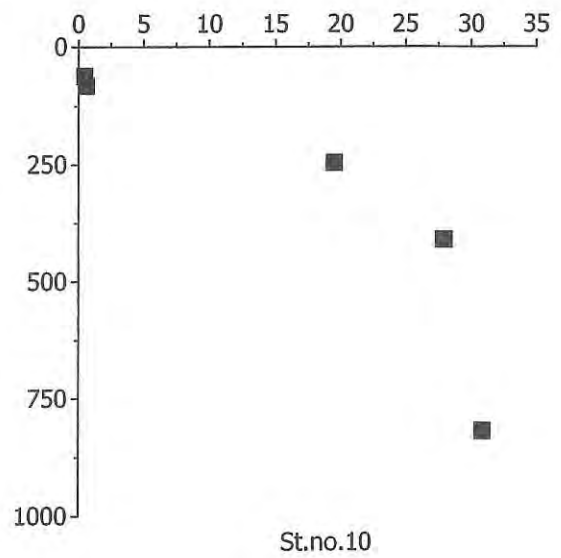
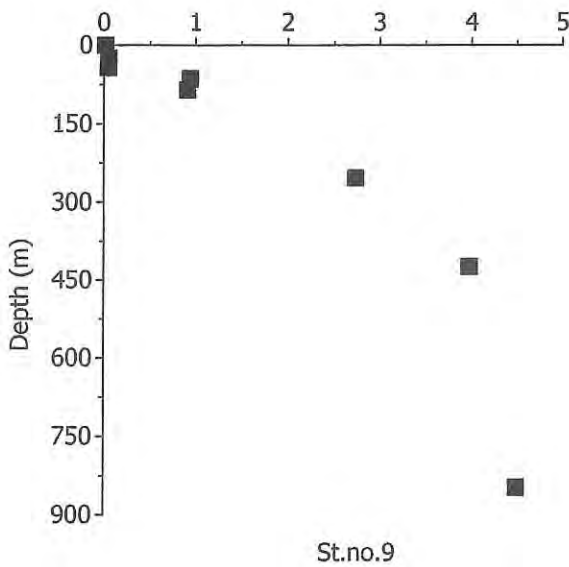
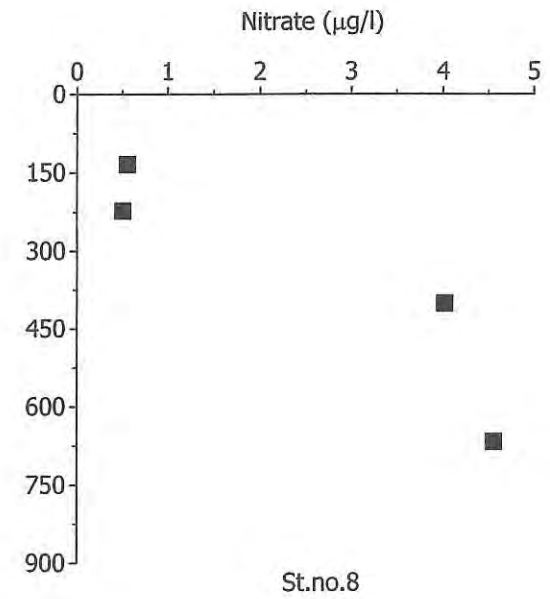
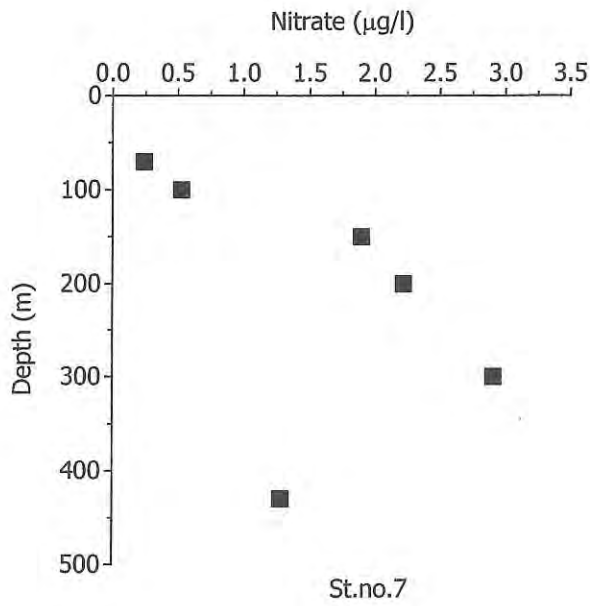


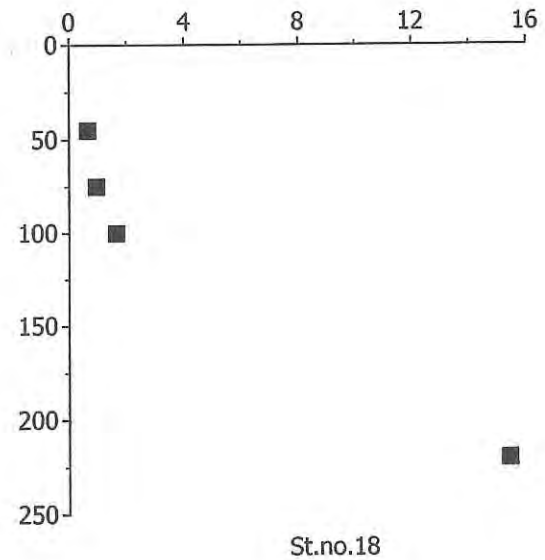
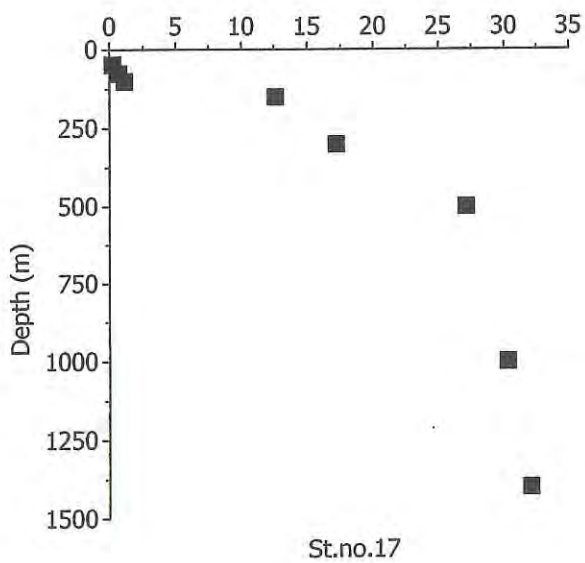
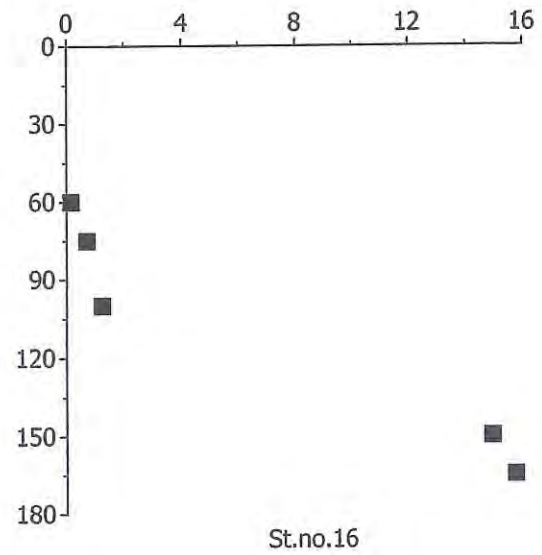
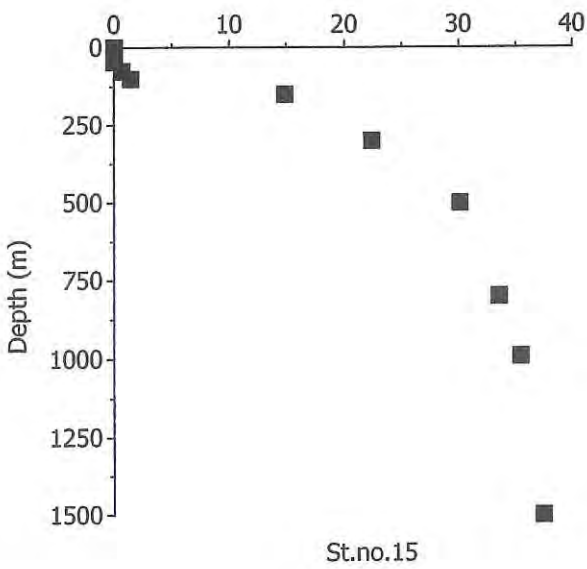
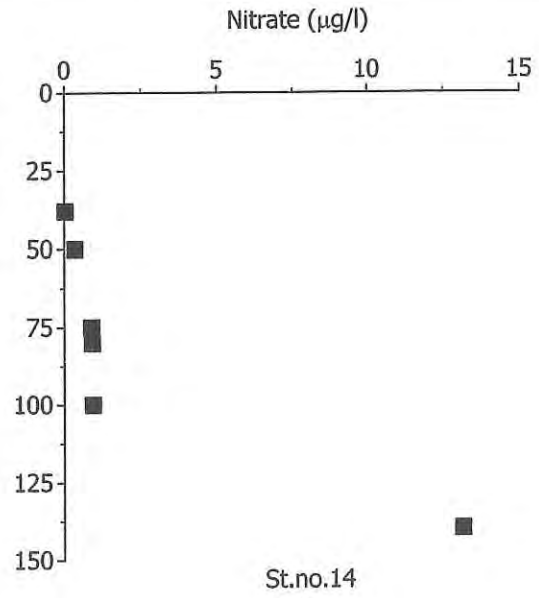
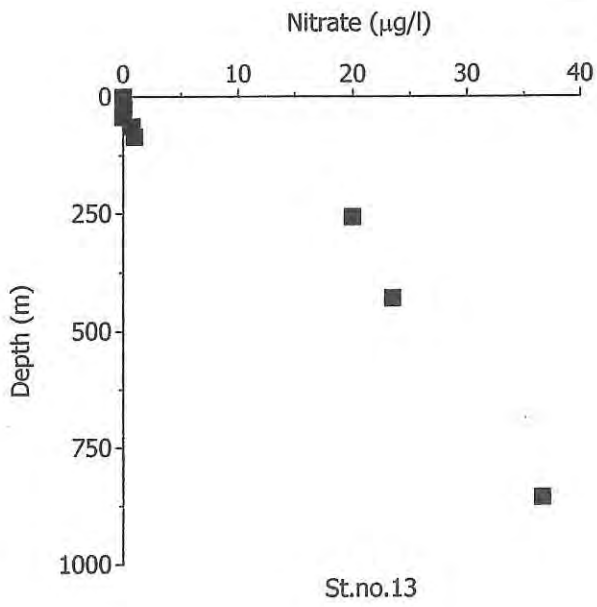


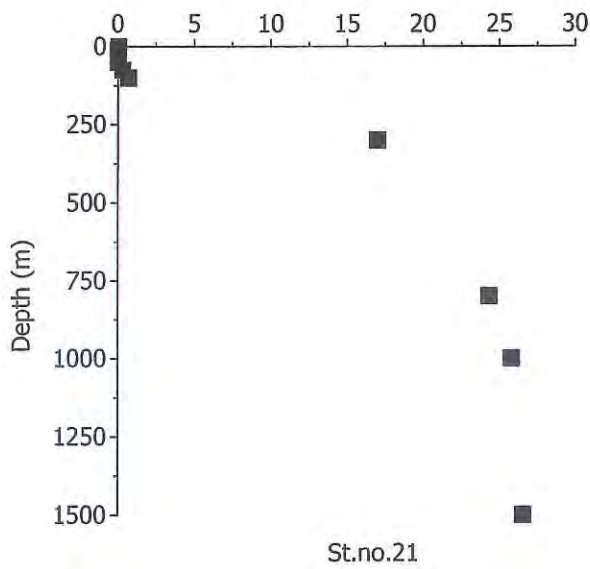
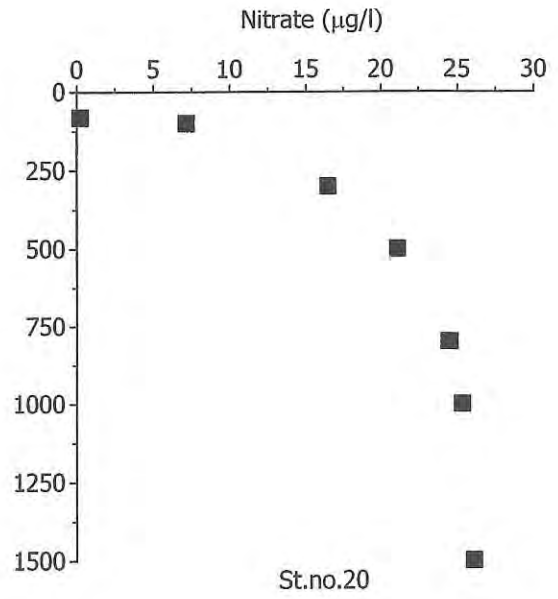
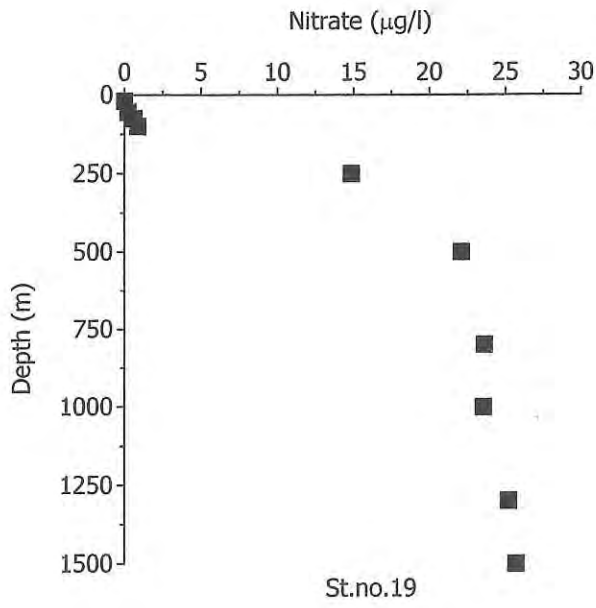


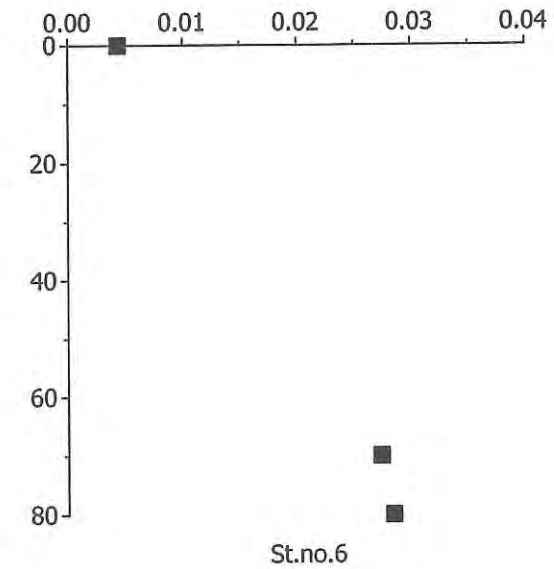
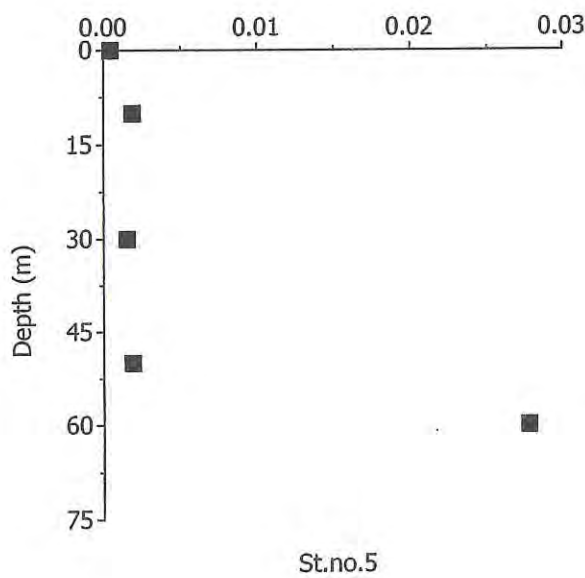
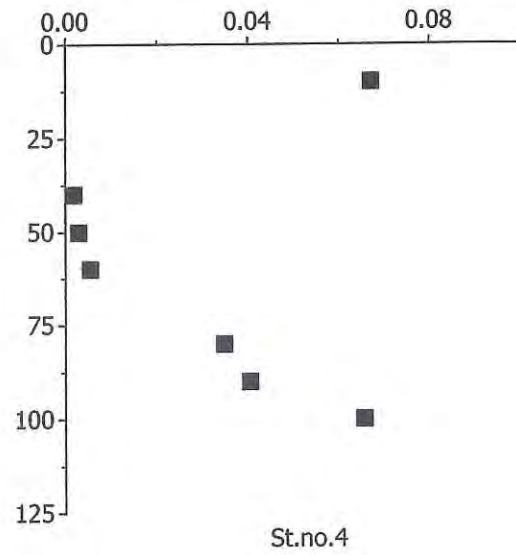
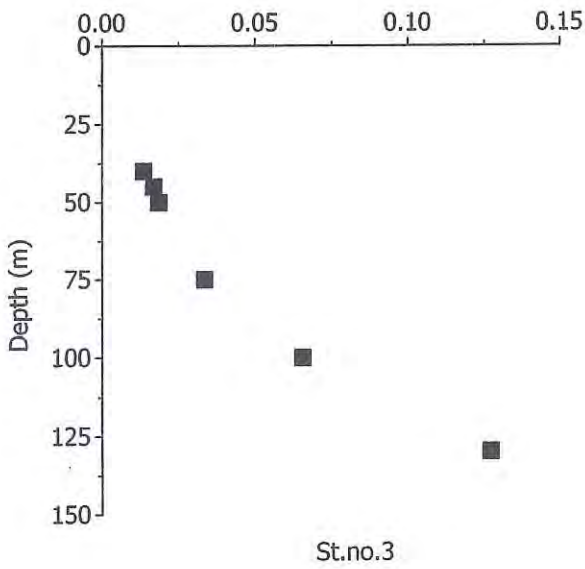
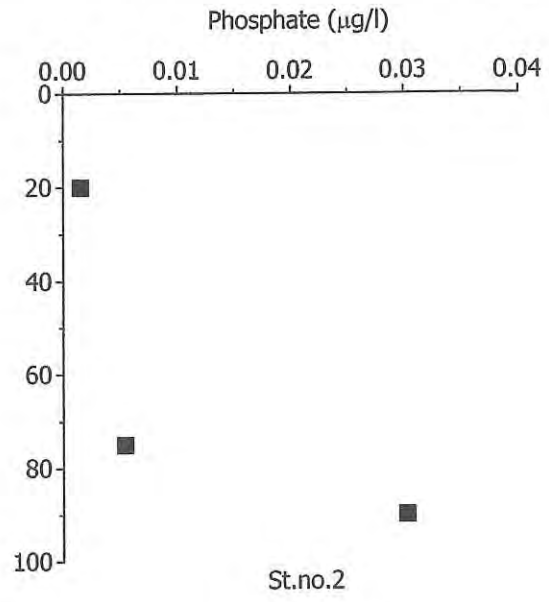
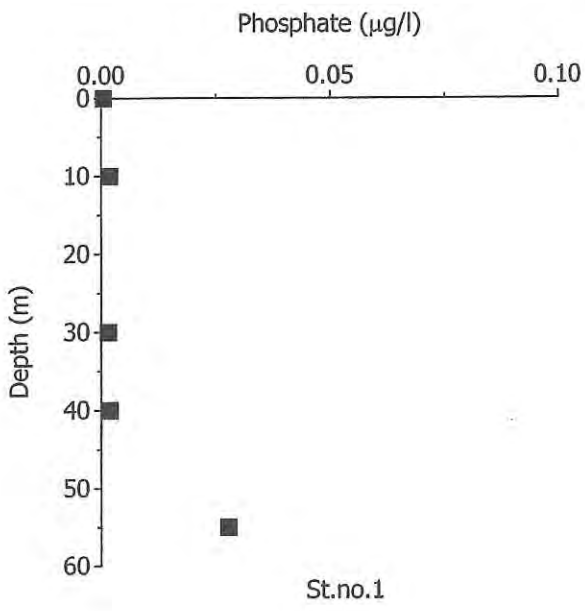
*The catalogue of Oceanographic Data; Collaborative Survey on Oceanic Squid in SCS,  
Phase II : Waters of Sabah, Sarawak and Brunei Darussalam*

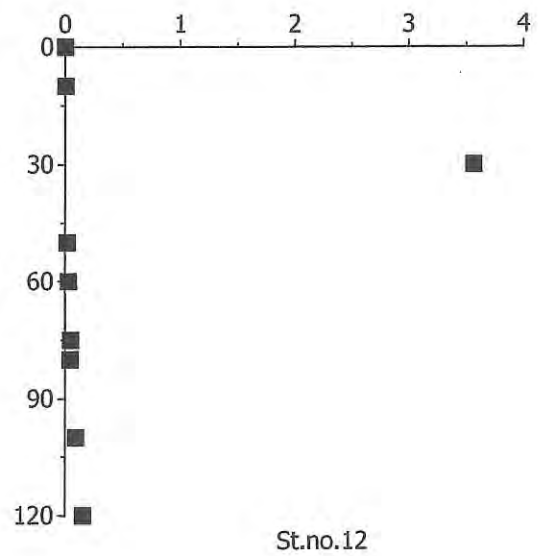
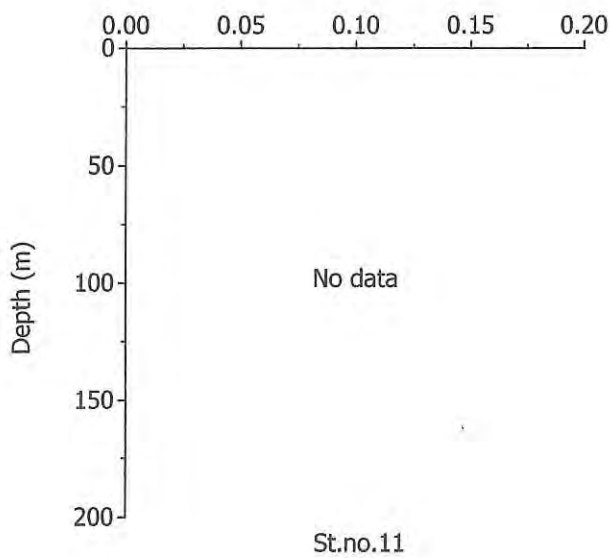
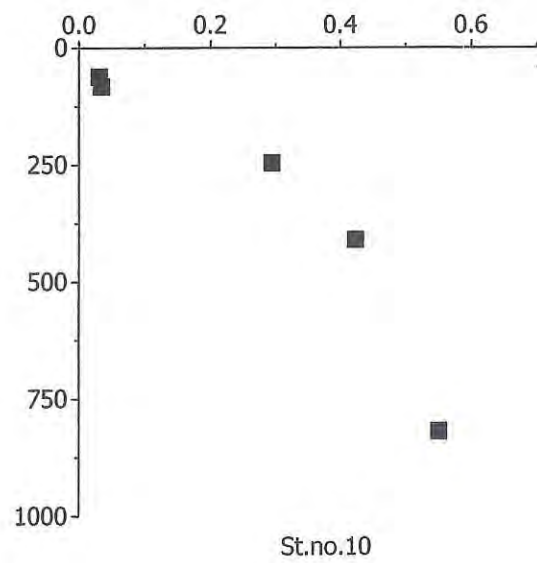
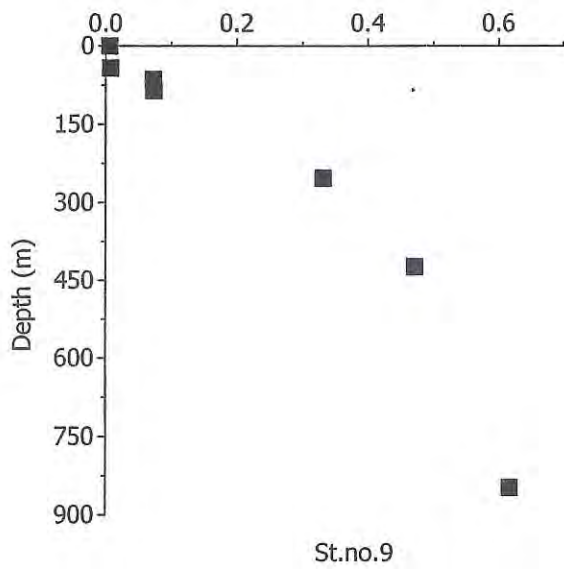
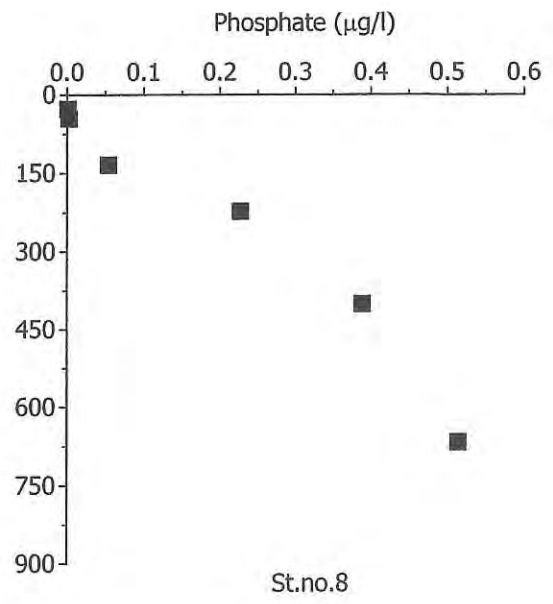
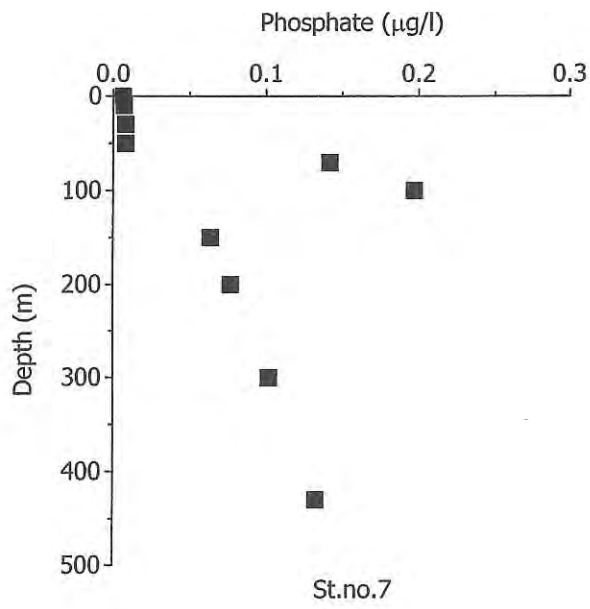


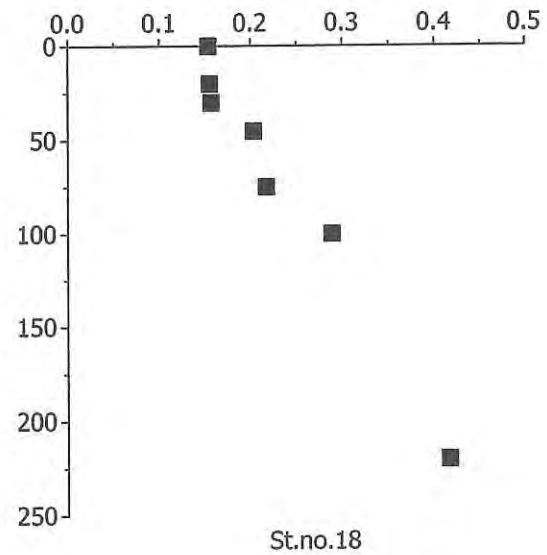
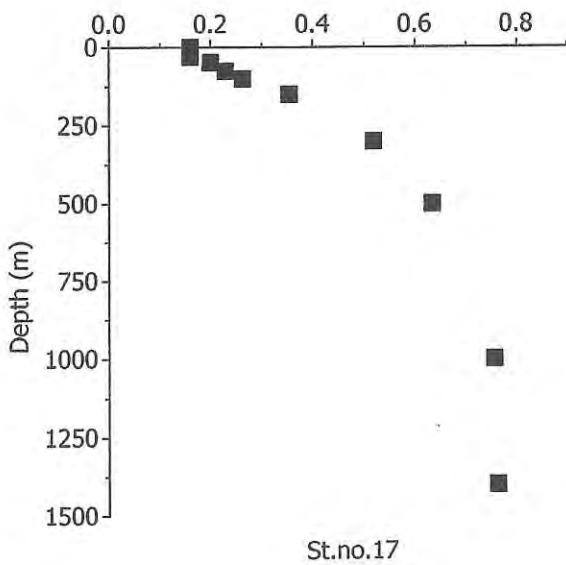
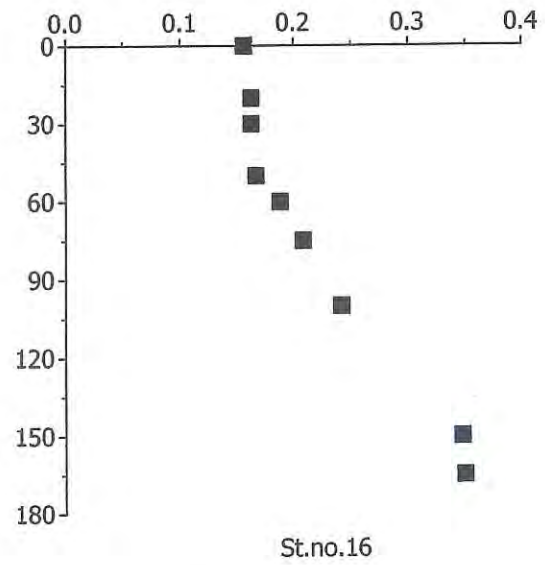
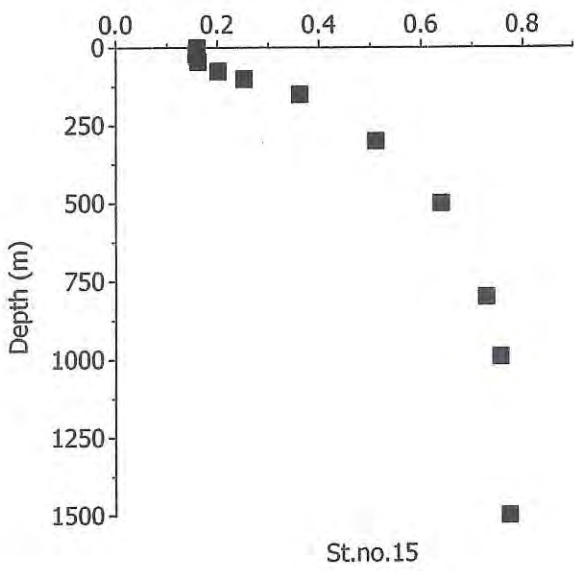
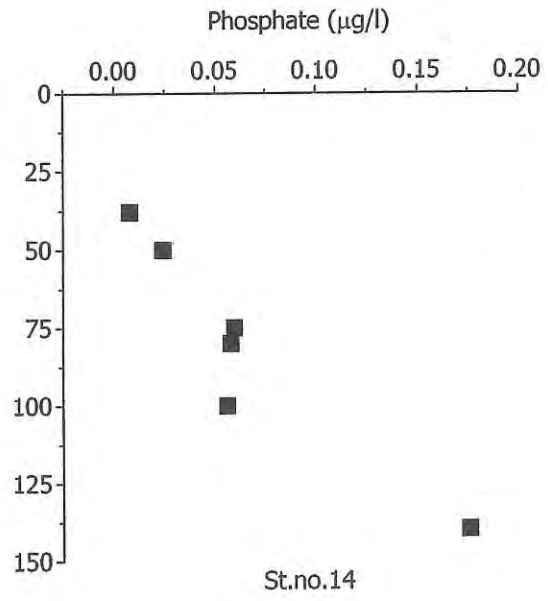
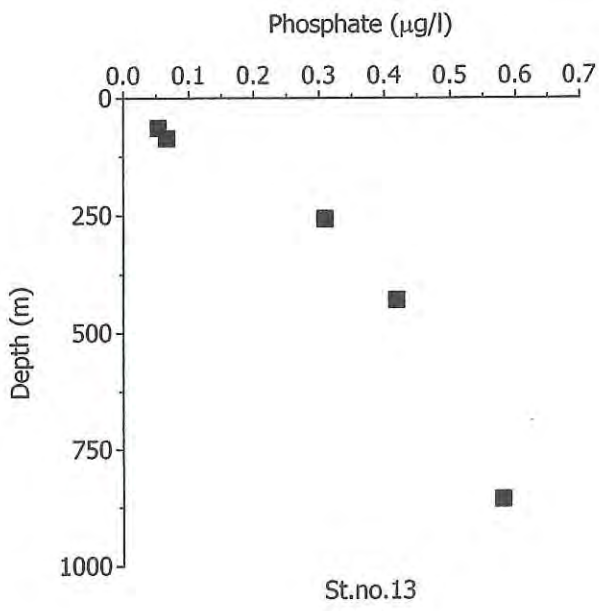




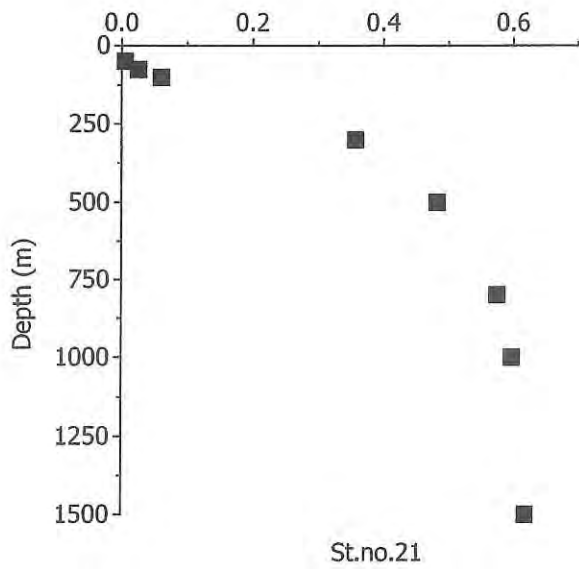
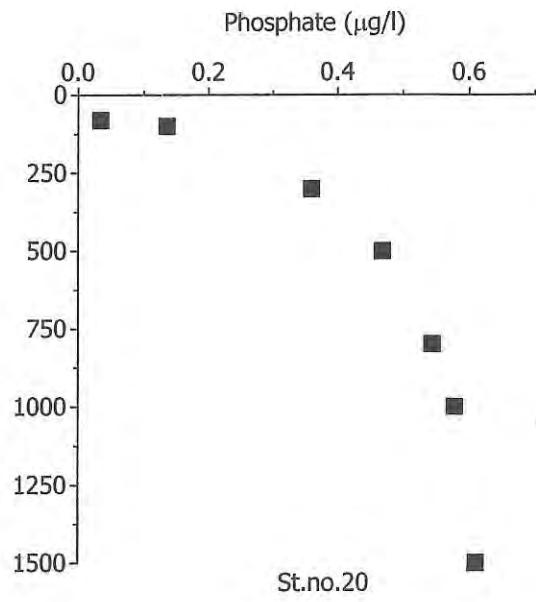
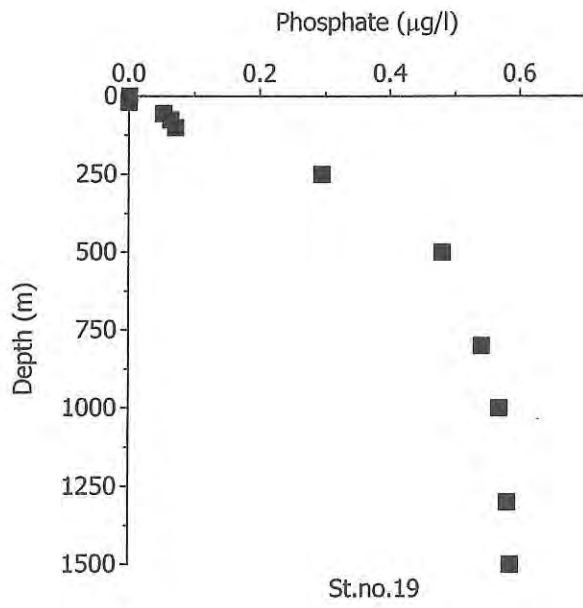


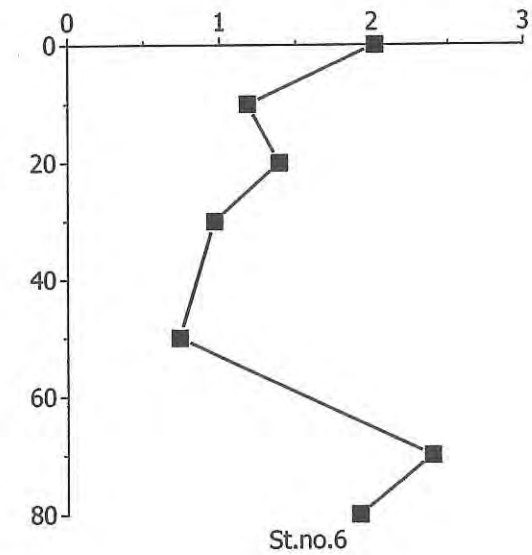
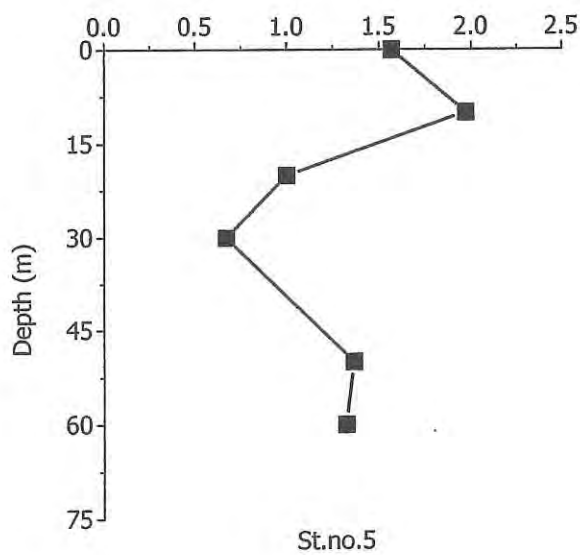
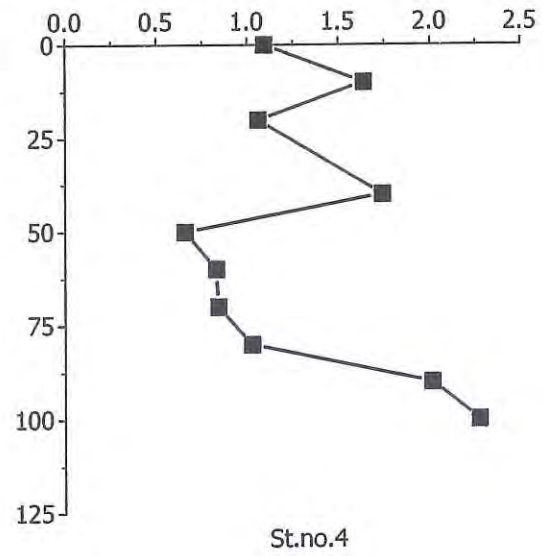
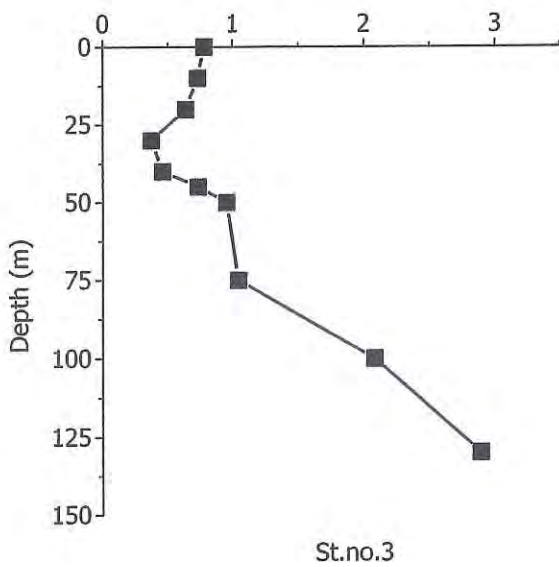
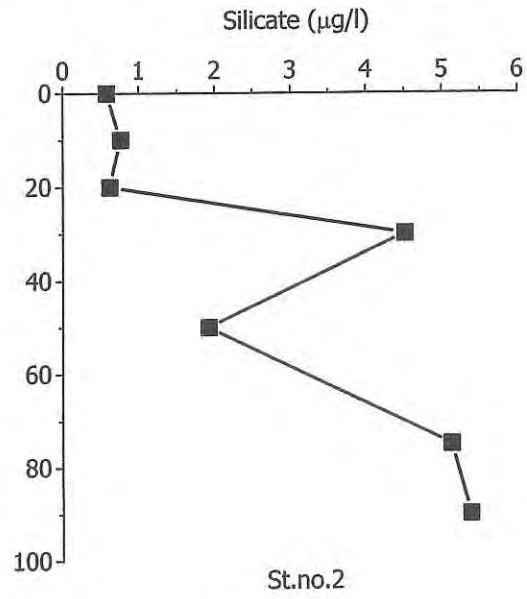
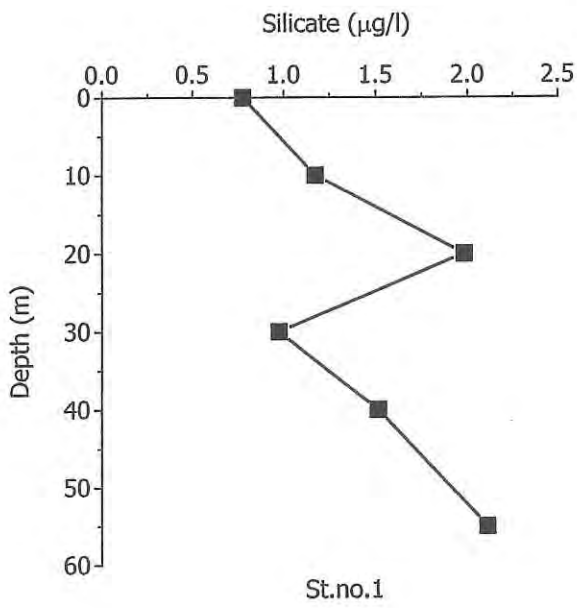


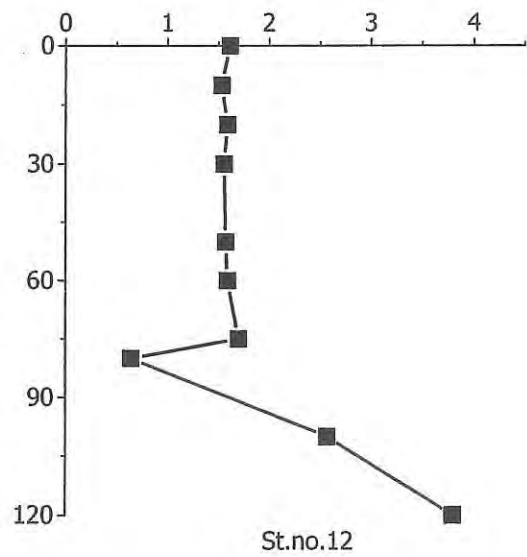
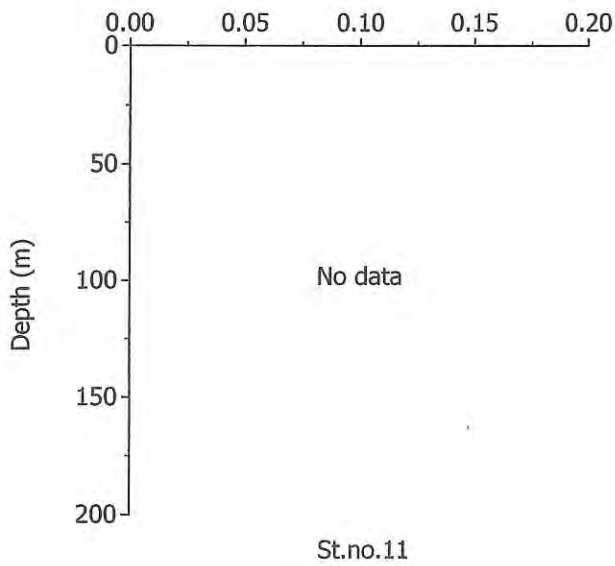
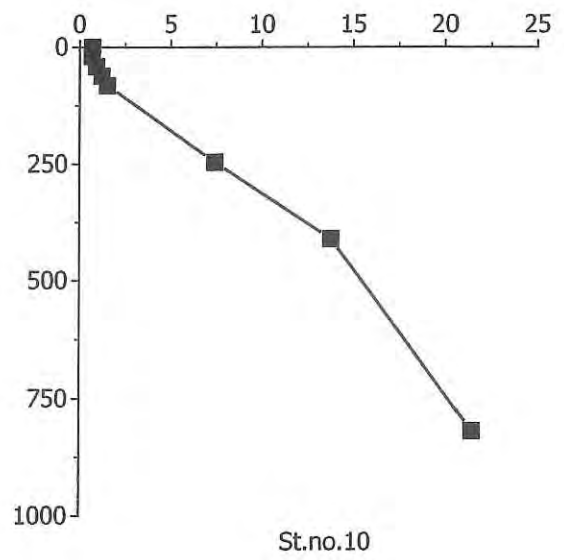
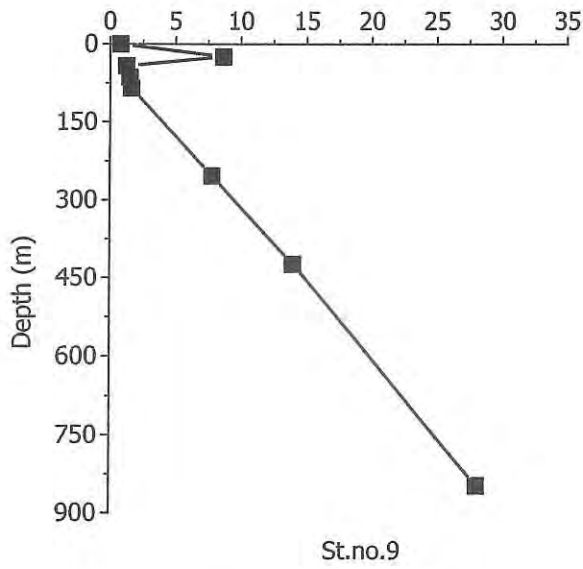
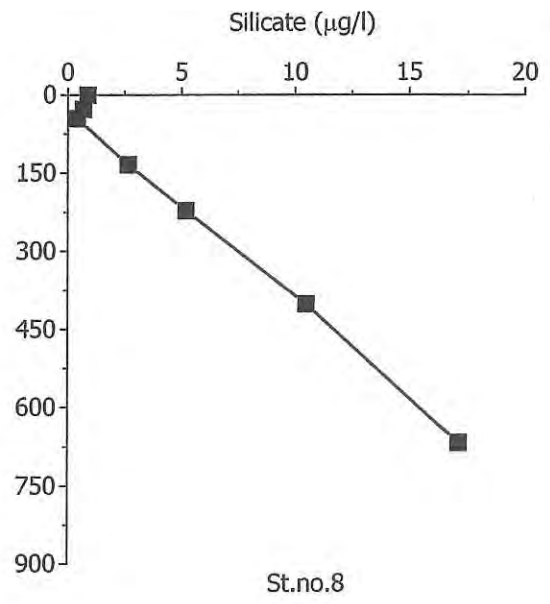
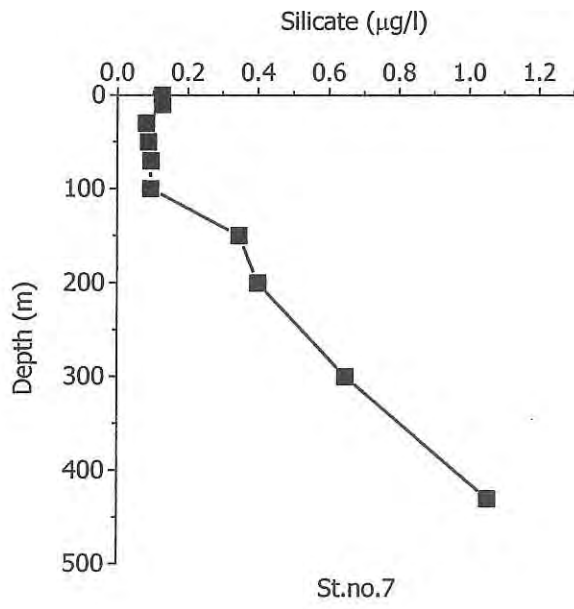


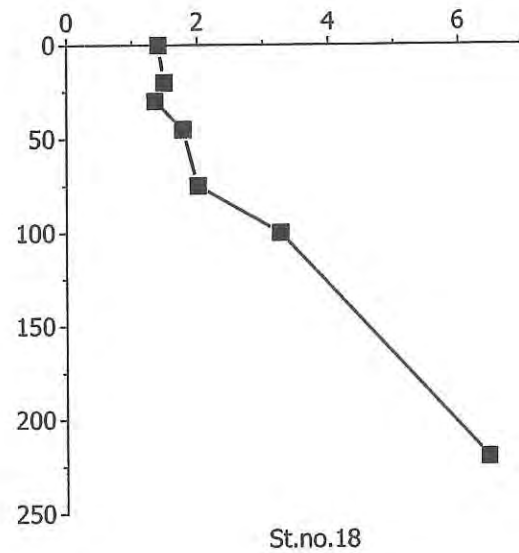
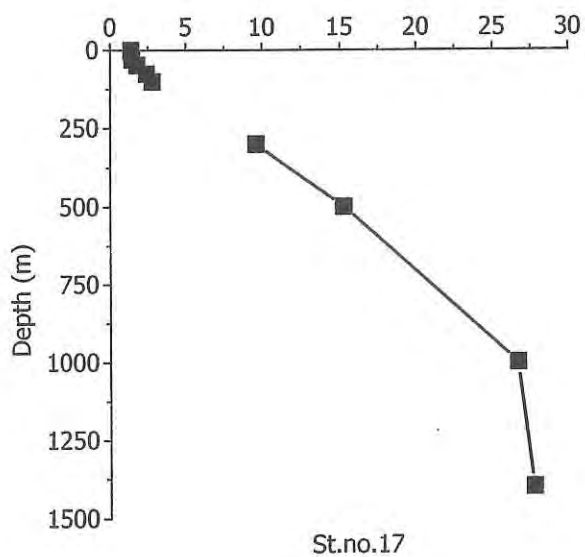
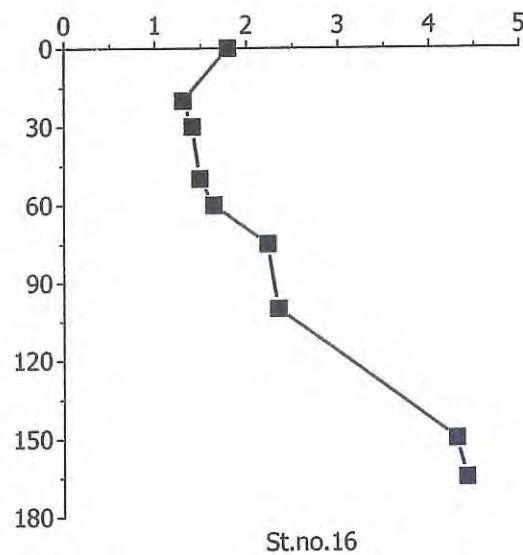
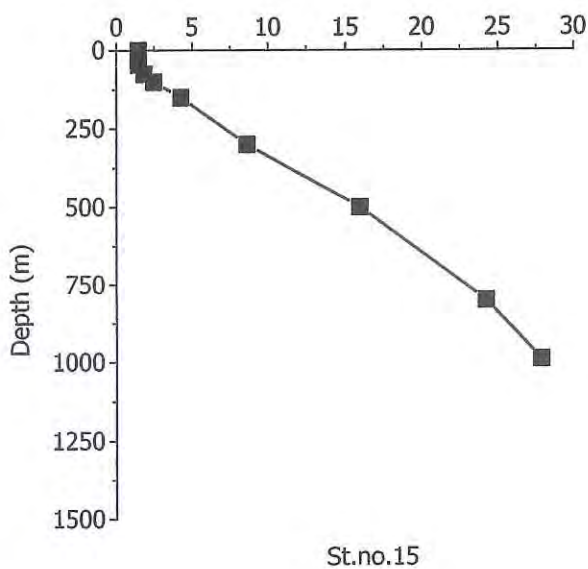
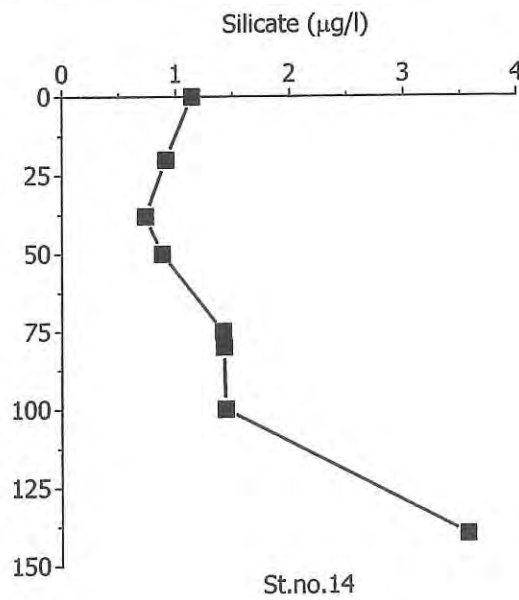
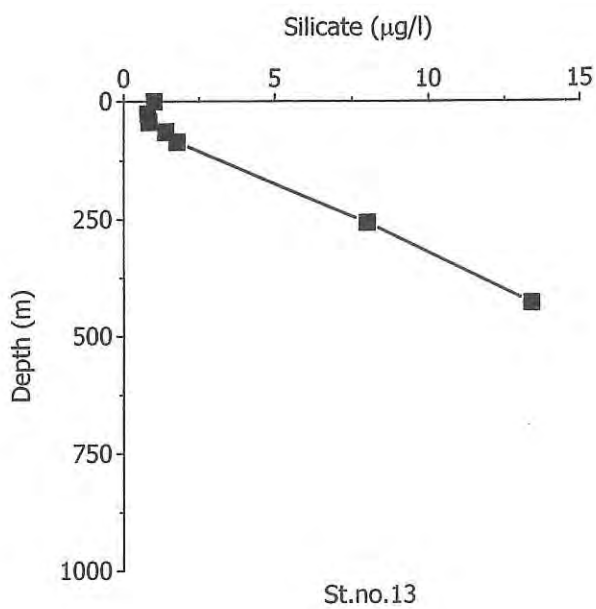


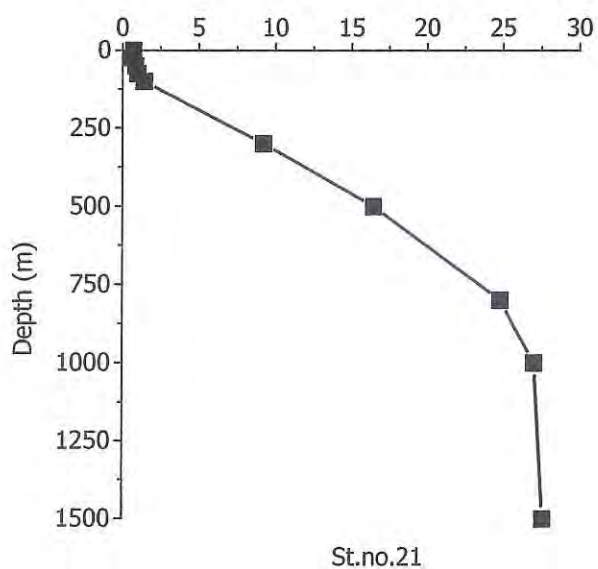
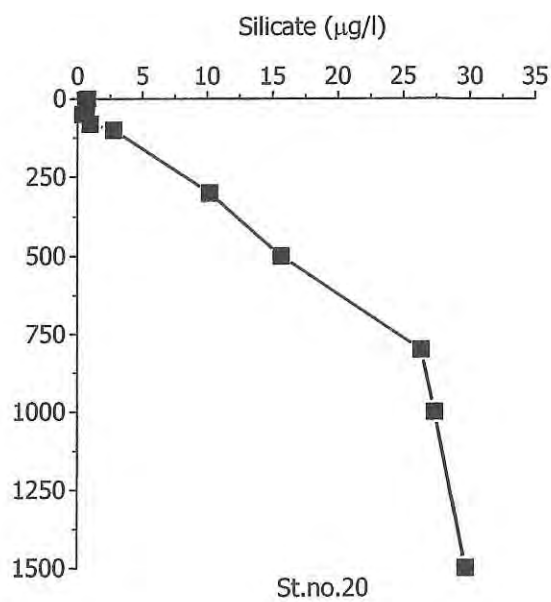
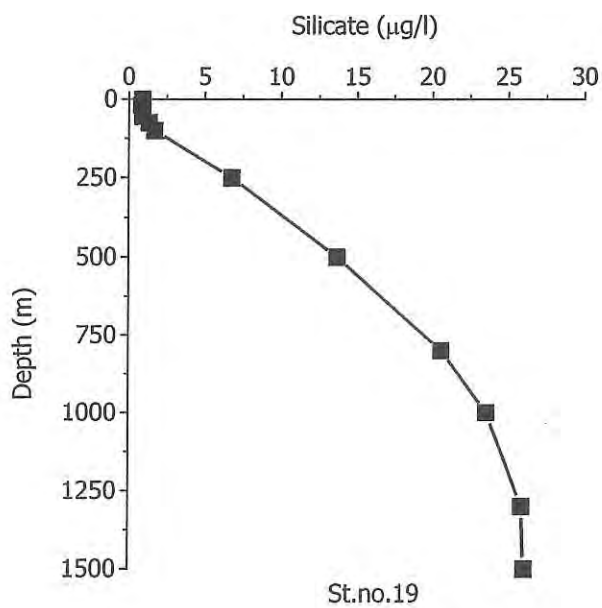


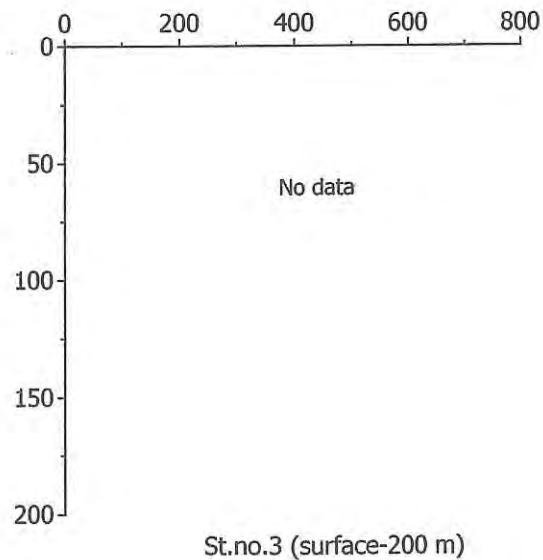
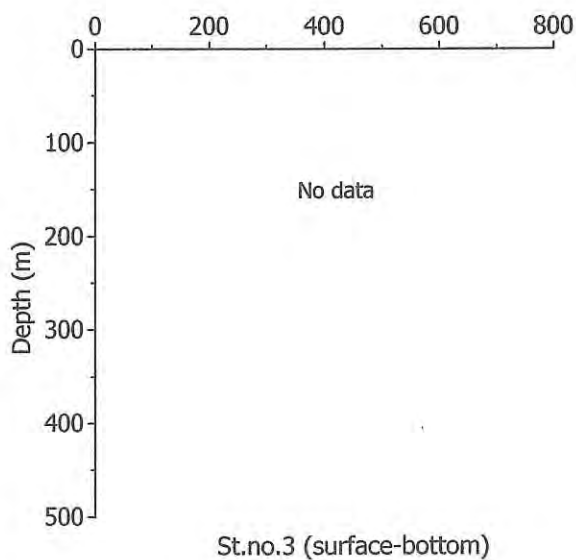
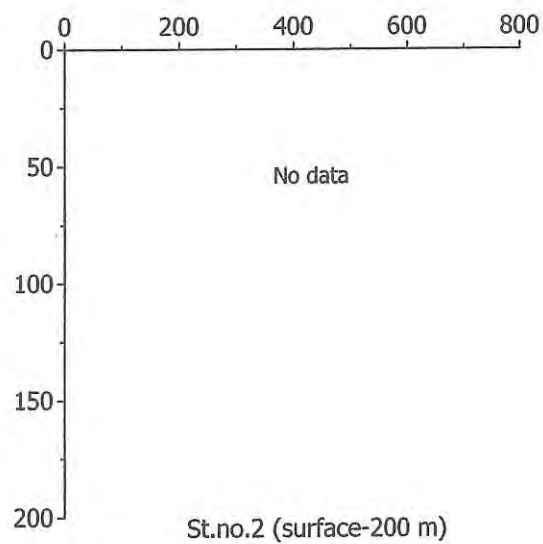
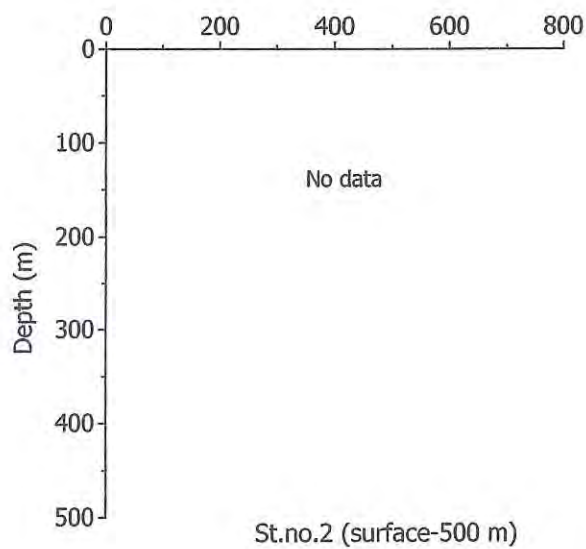
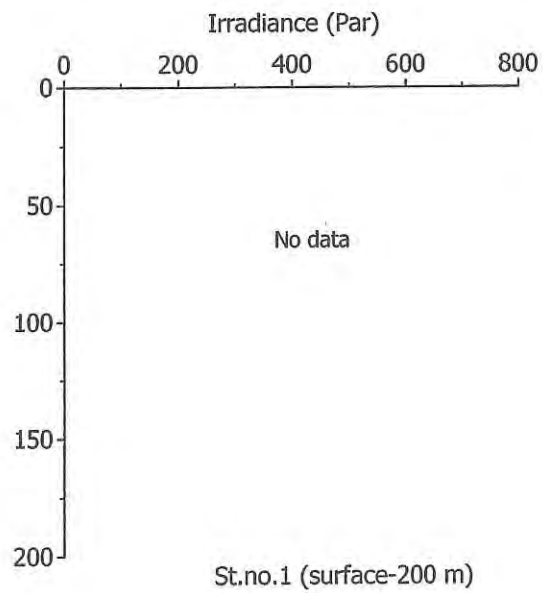
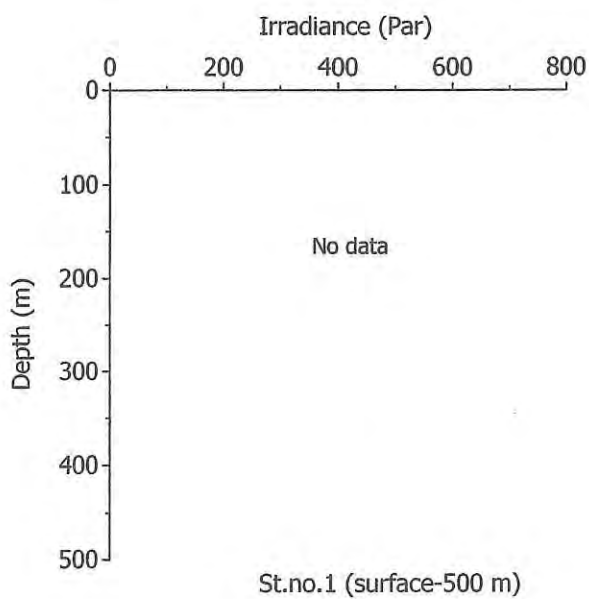


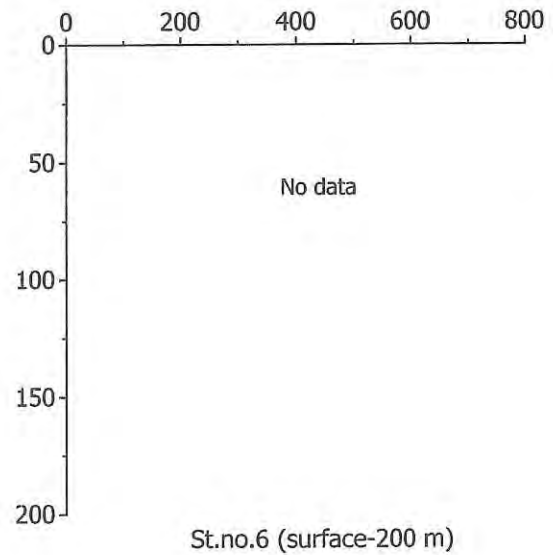
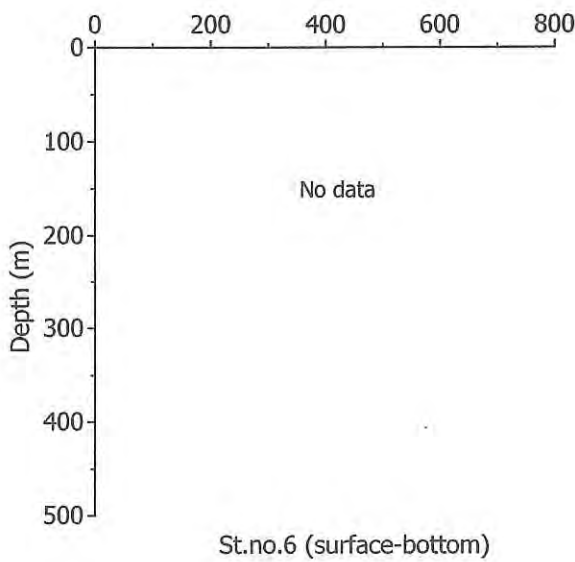
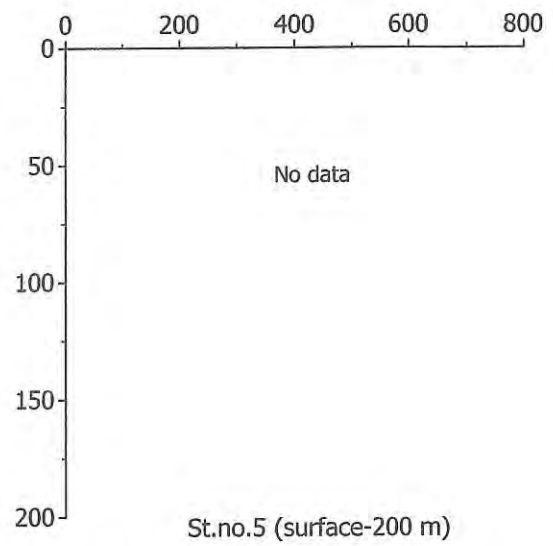
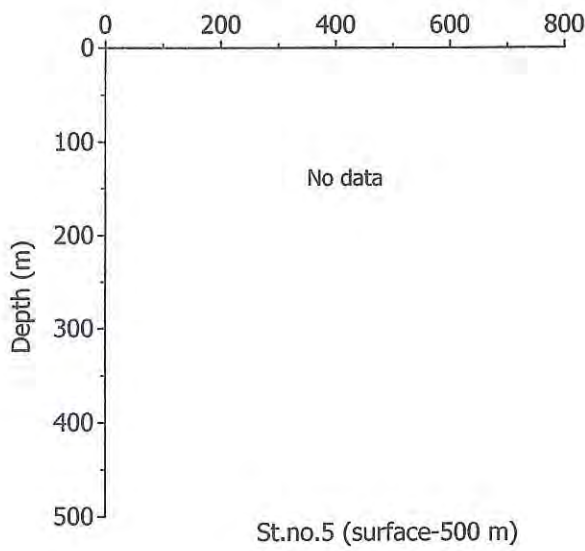
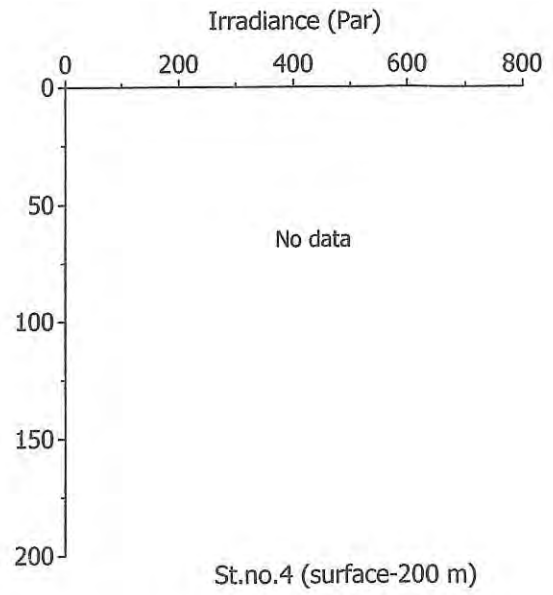
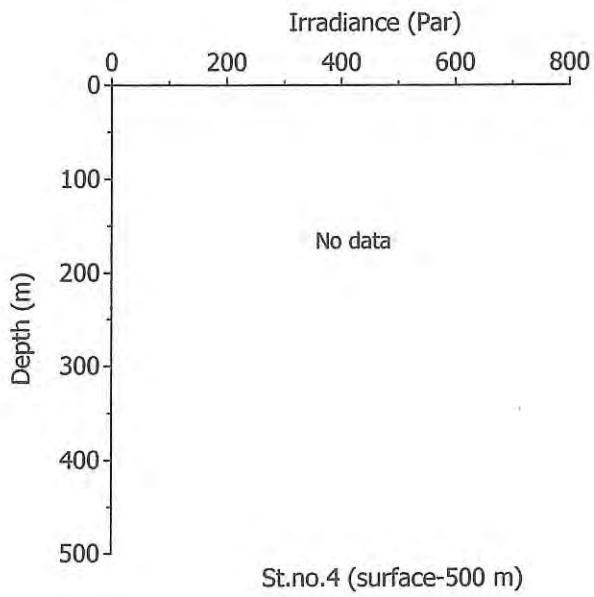


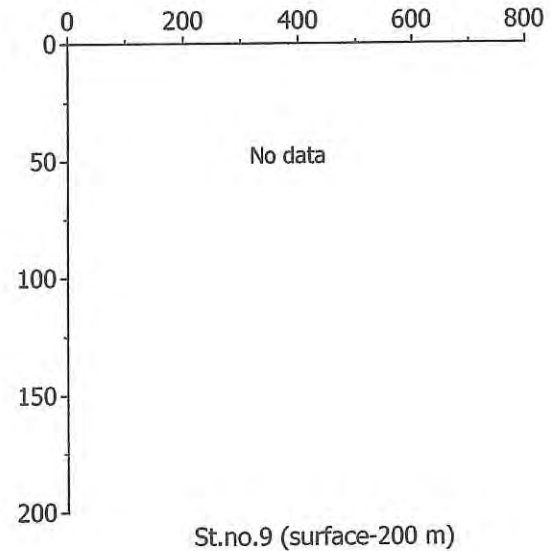
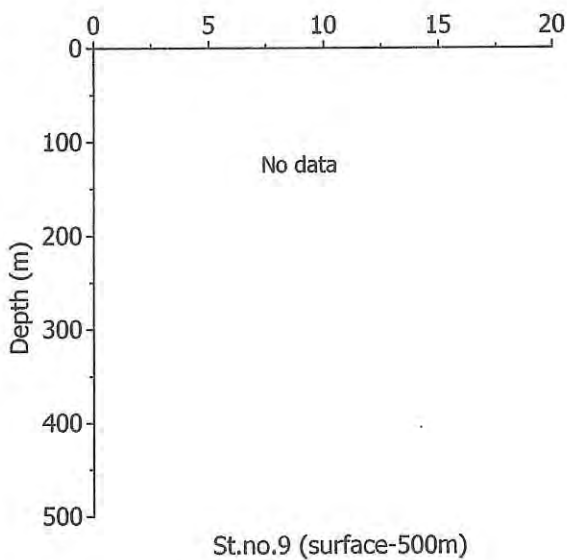
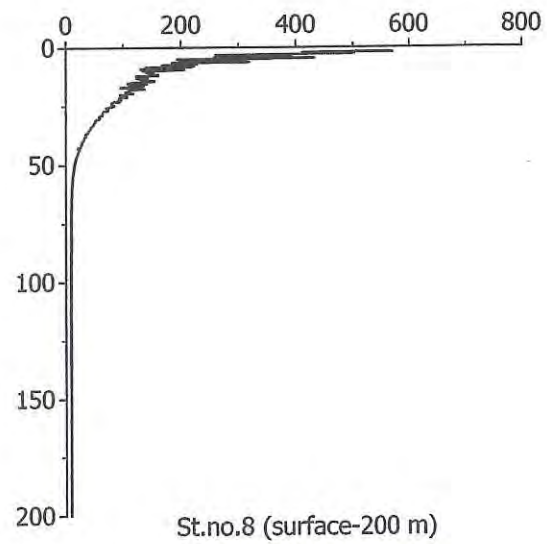
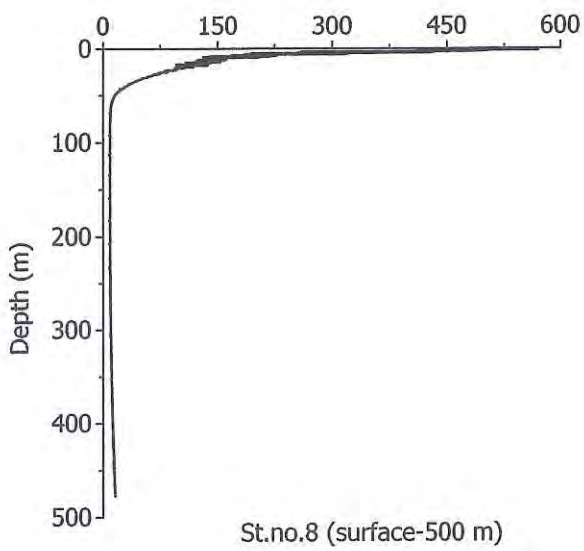
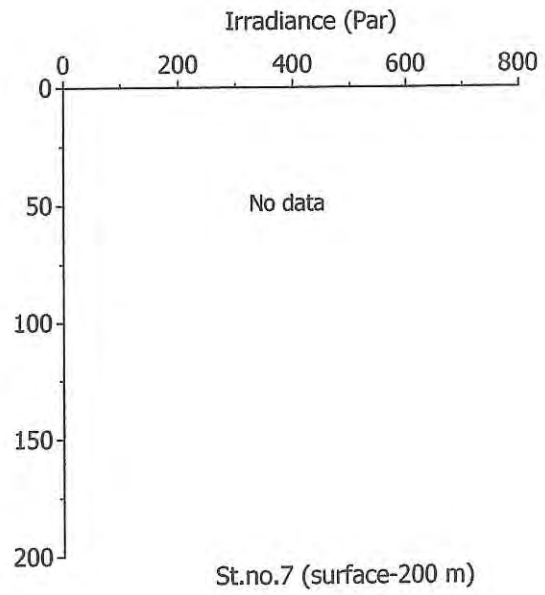
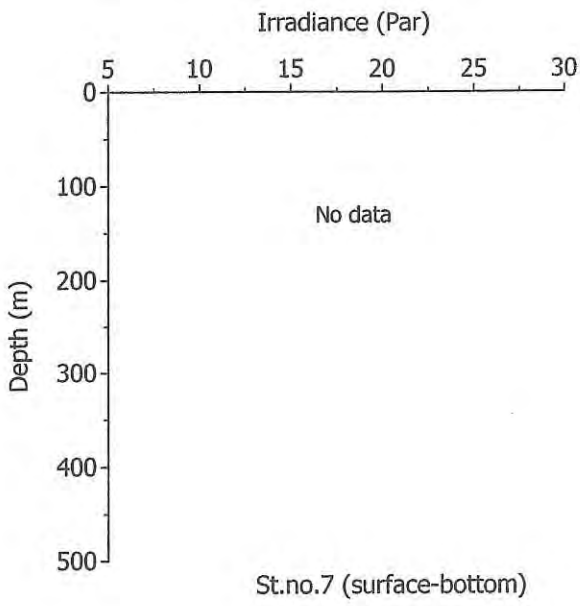




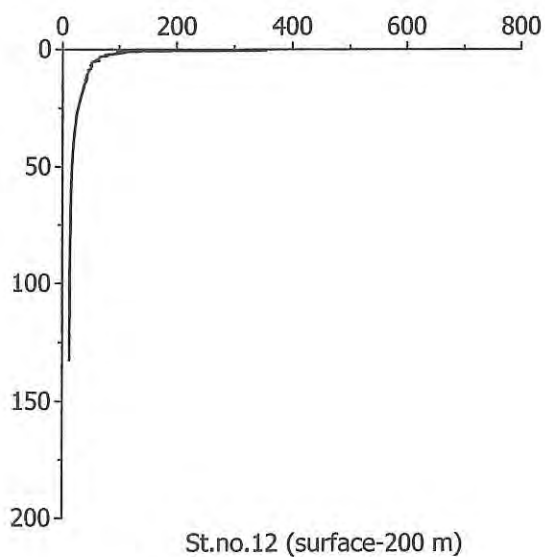
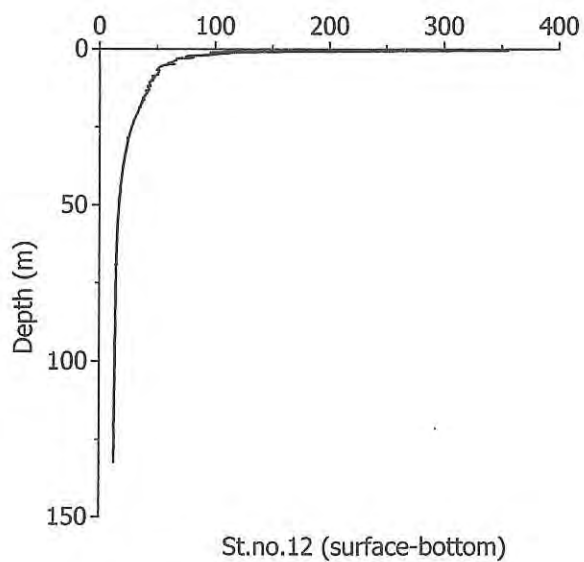
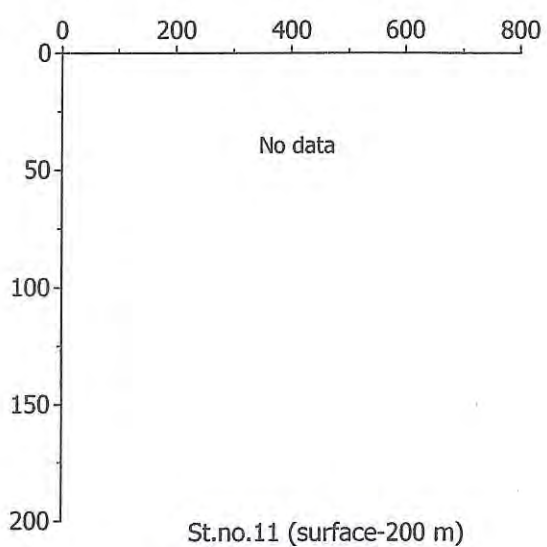
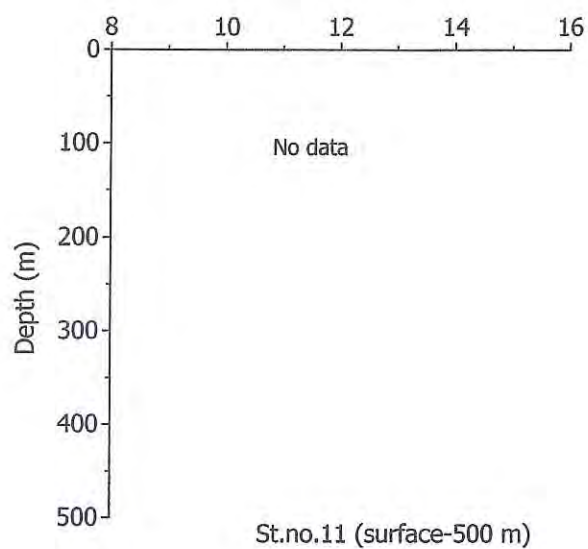
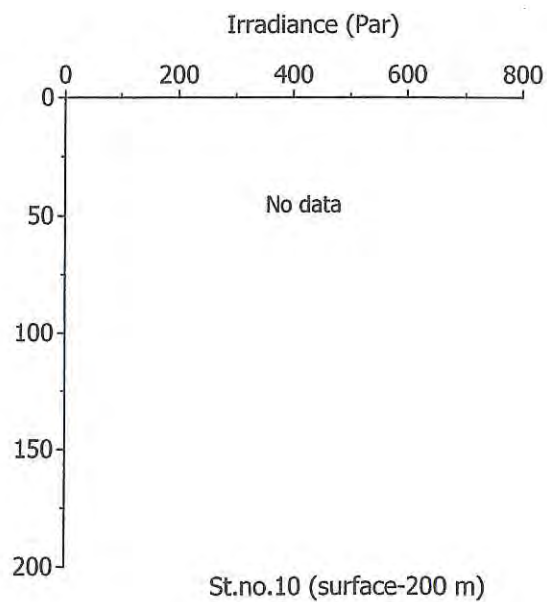
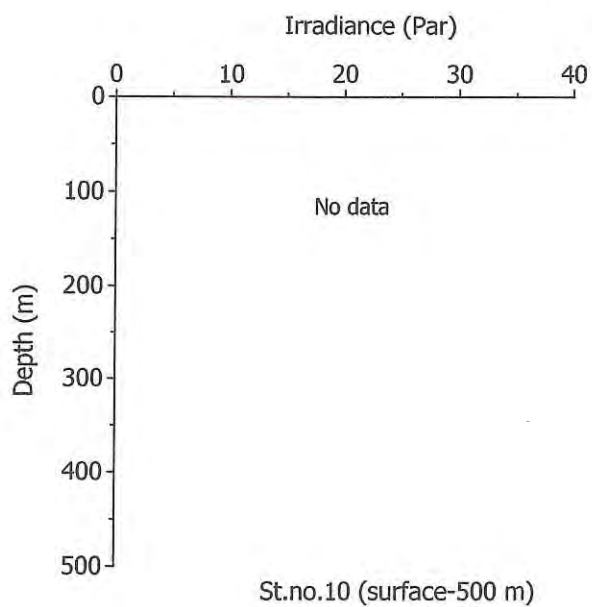


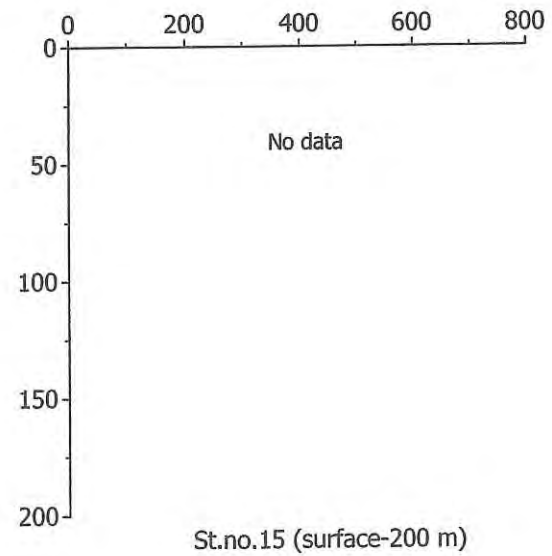
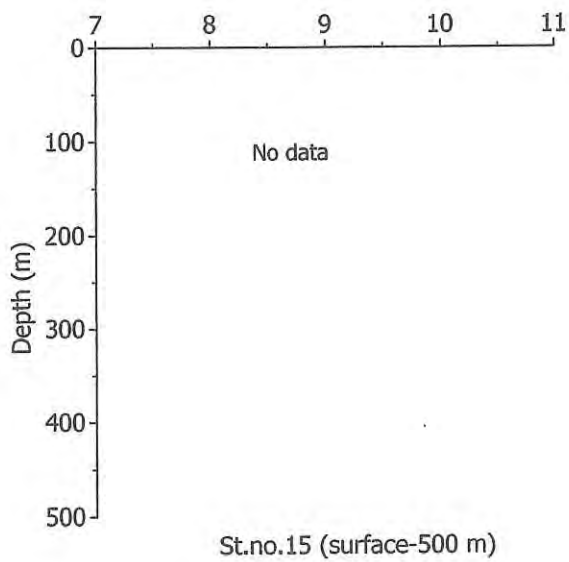
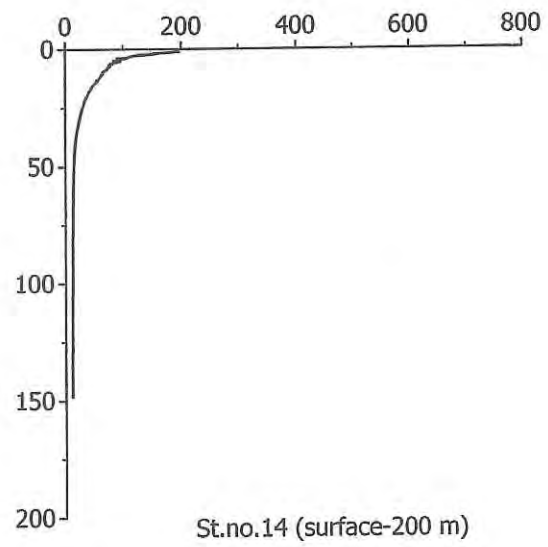
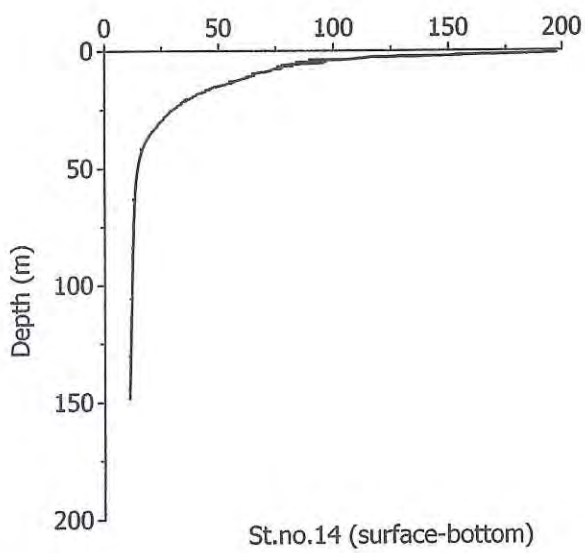
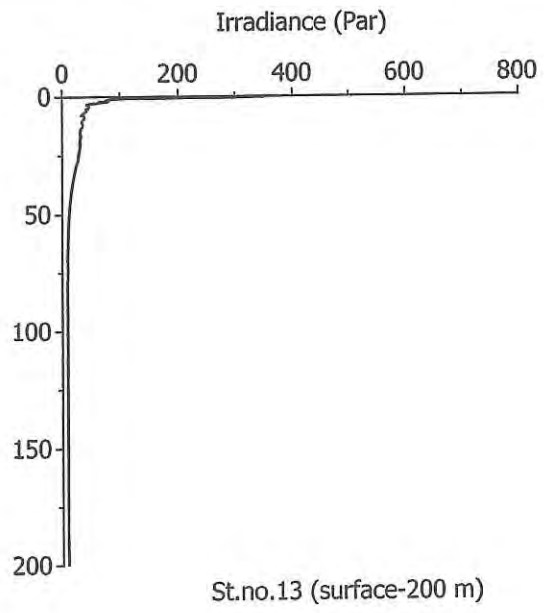
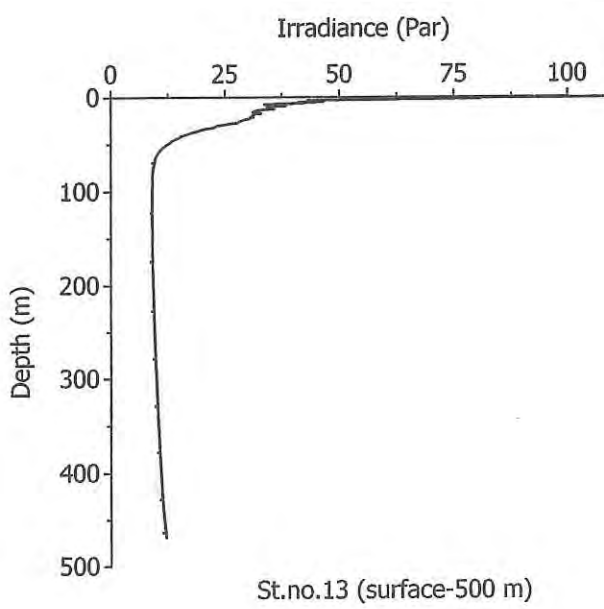


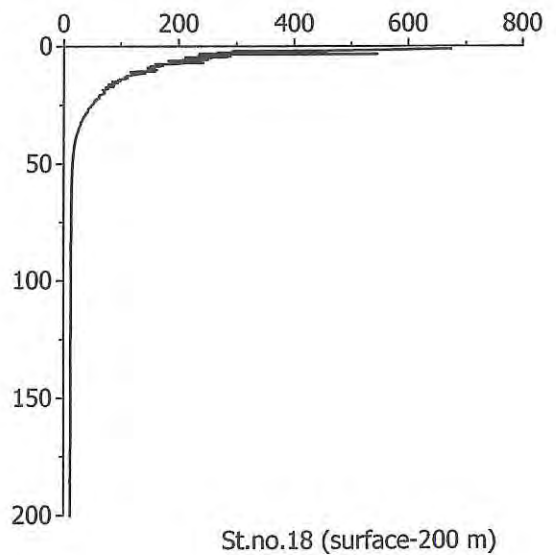
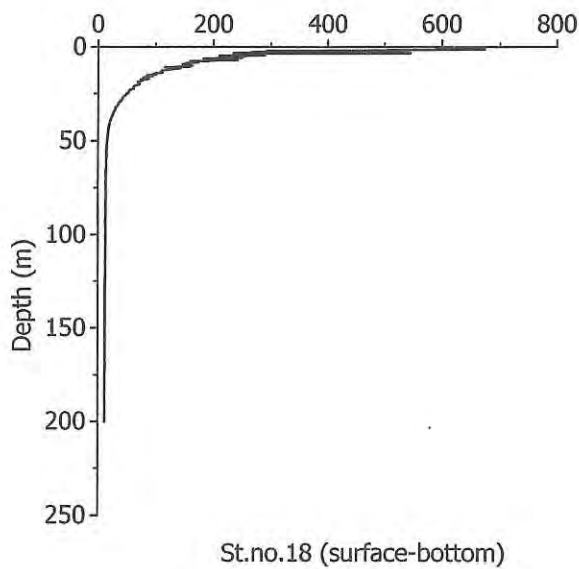
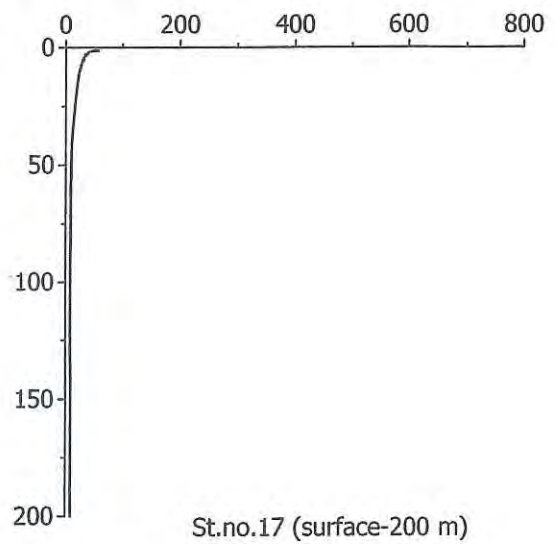
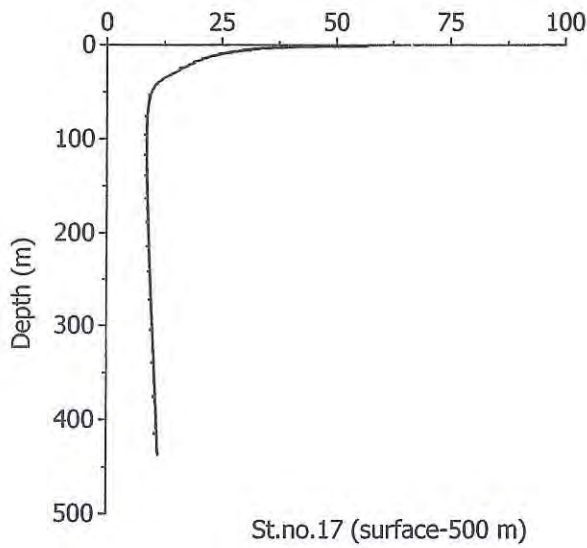
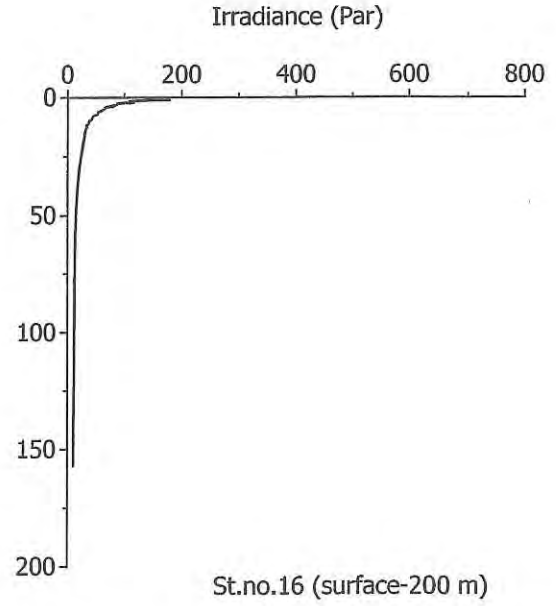
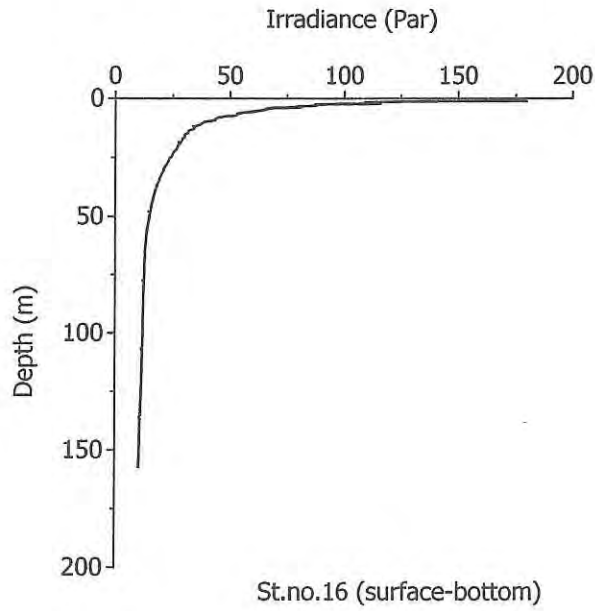


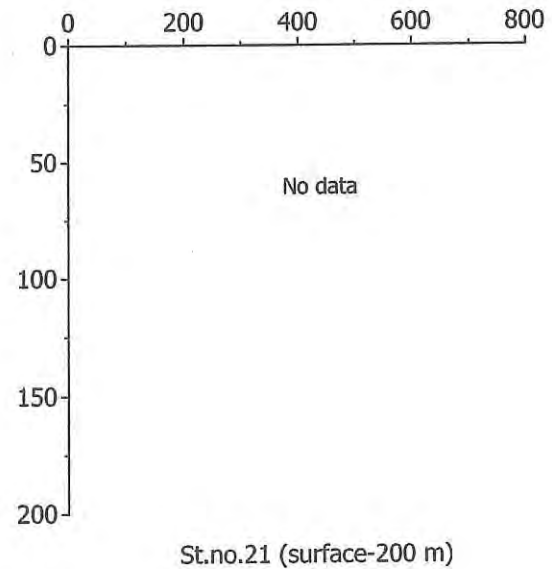
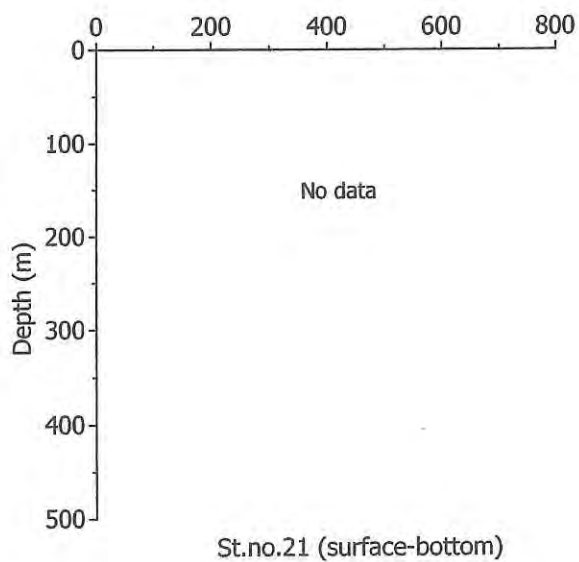
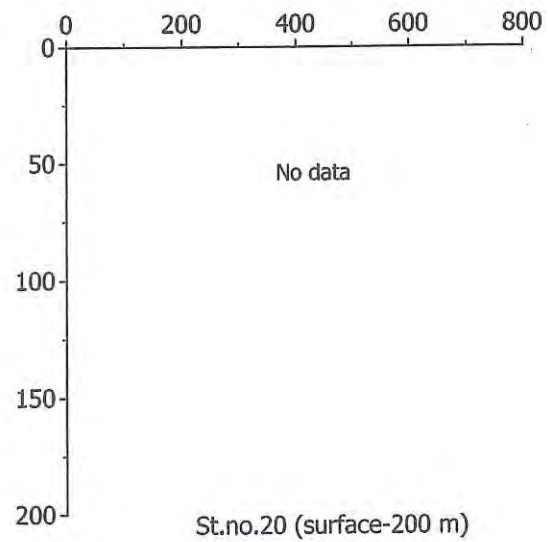
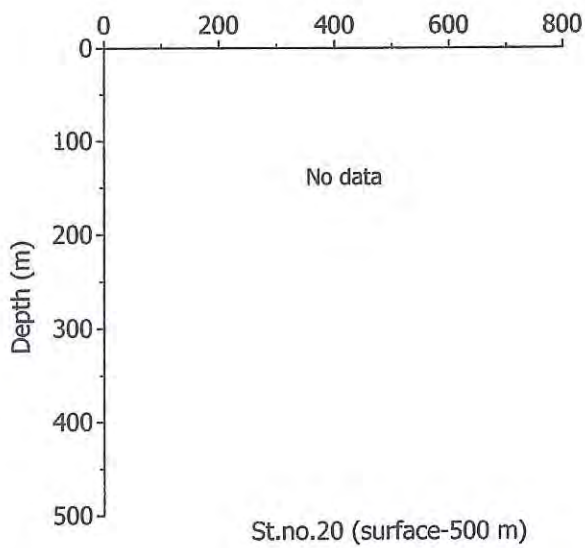
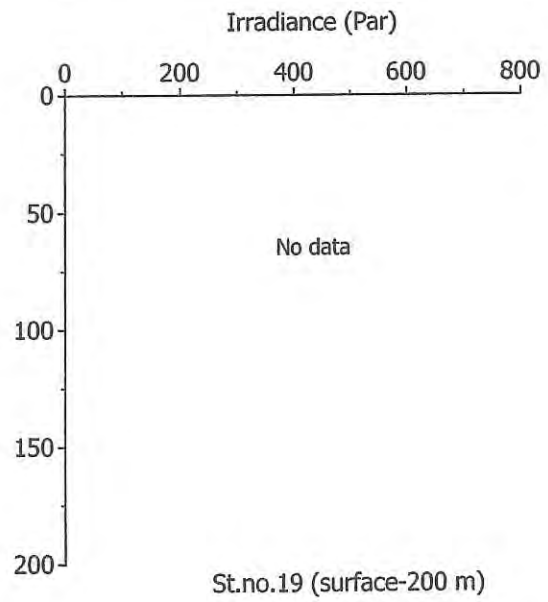
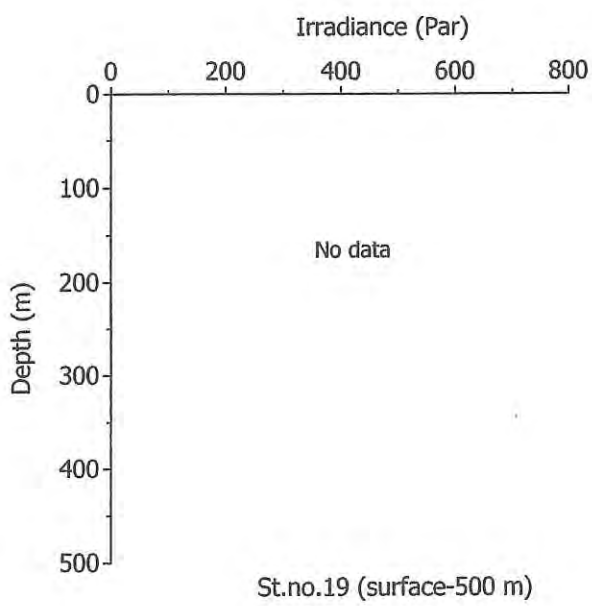






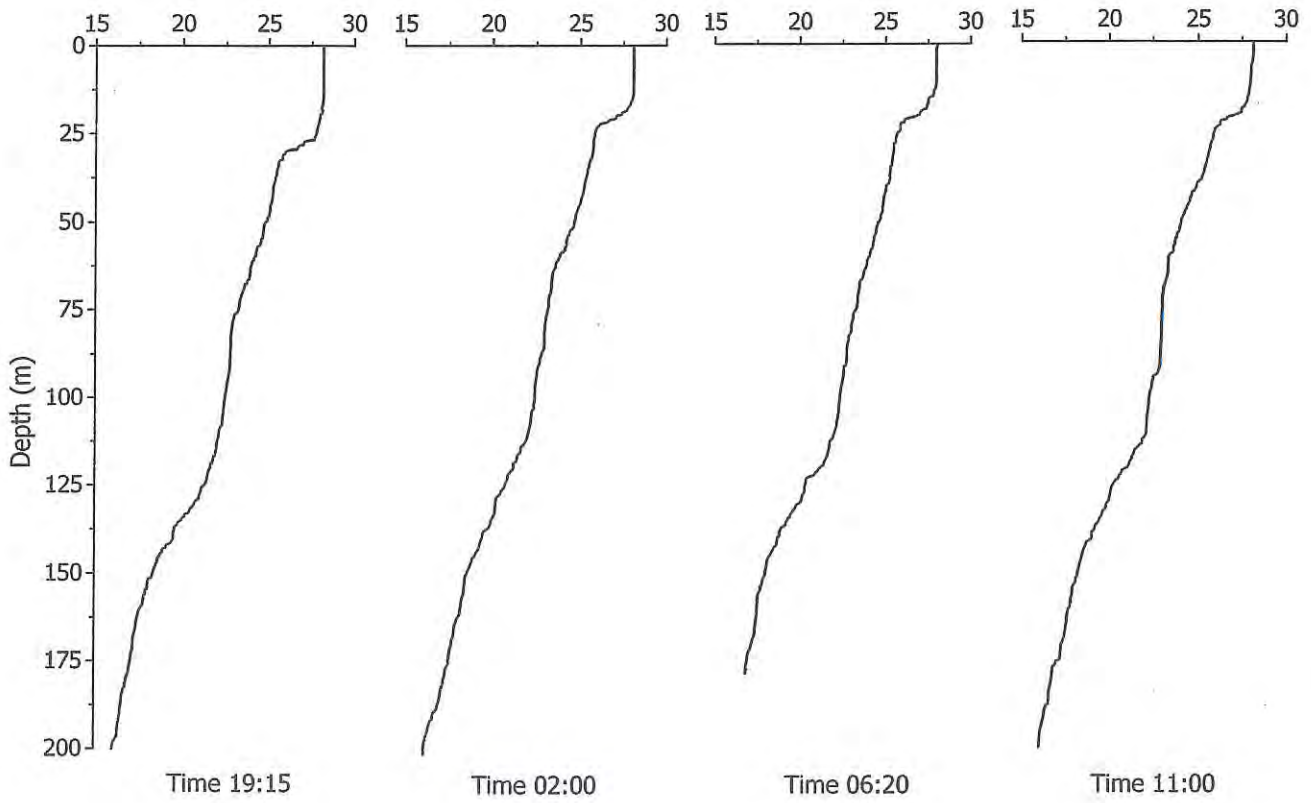




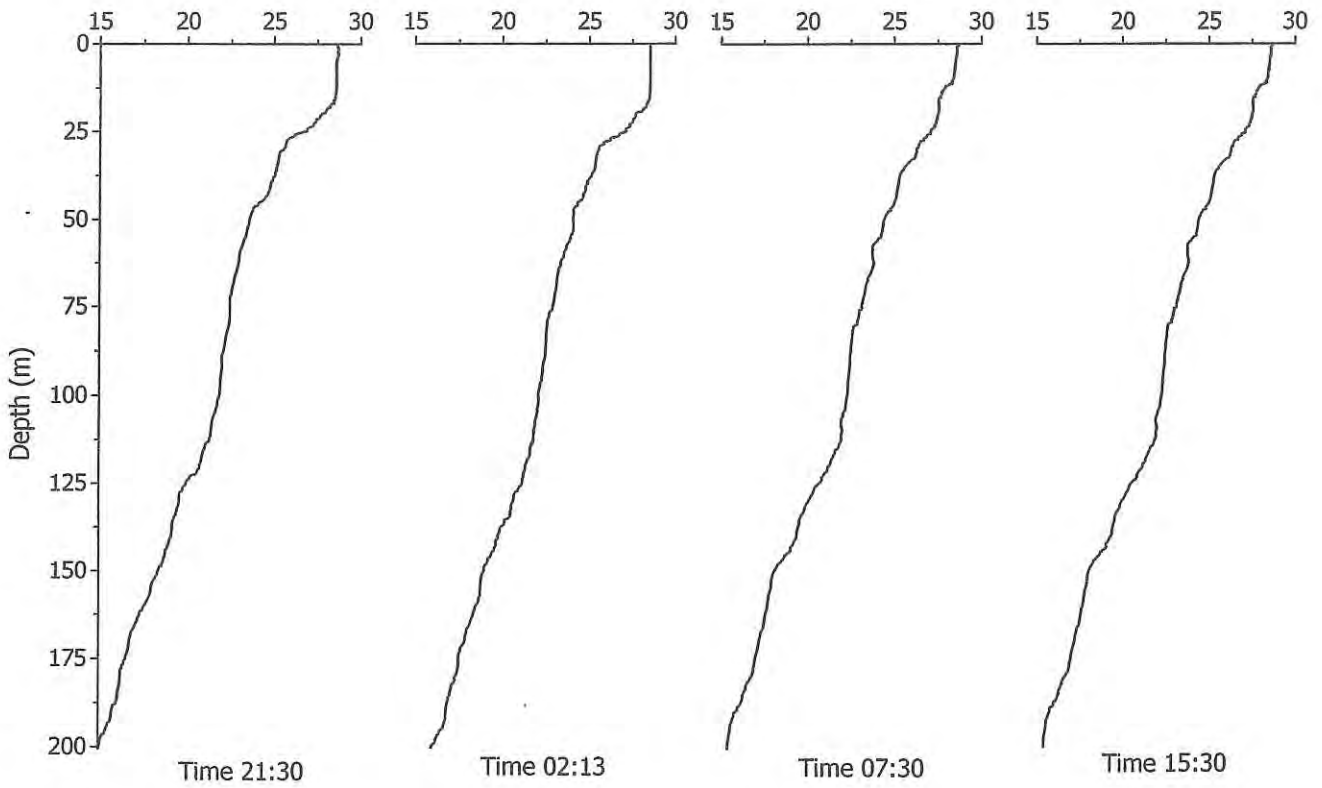




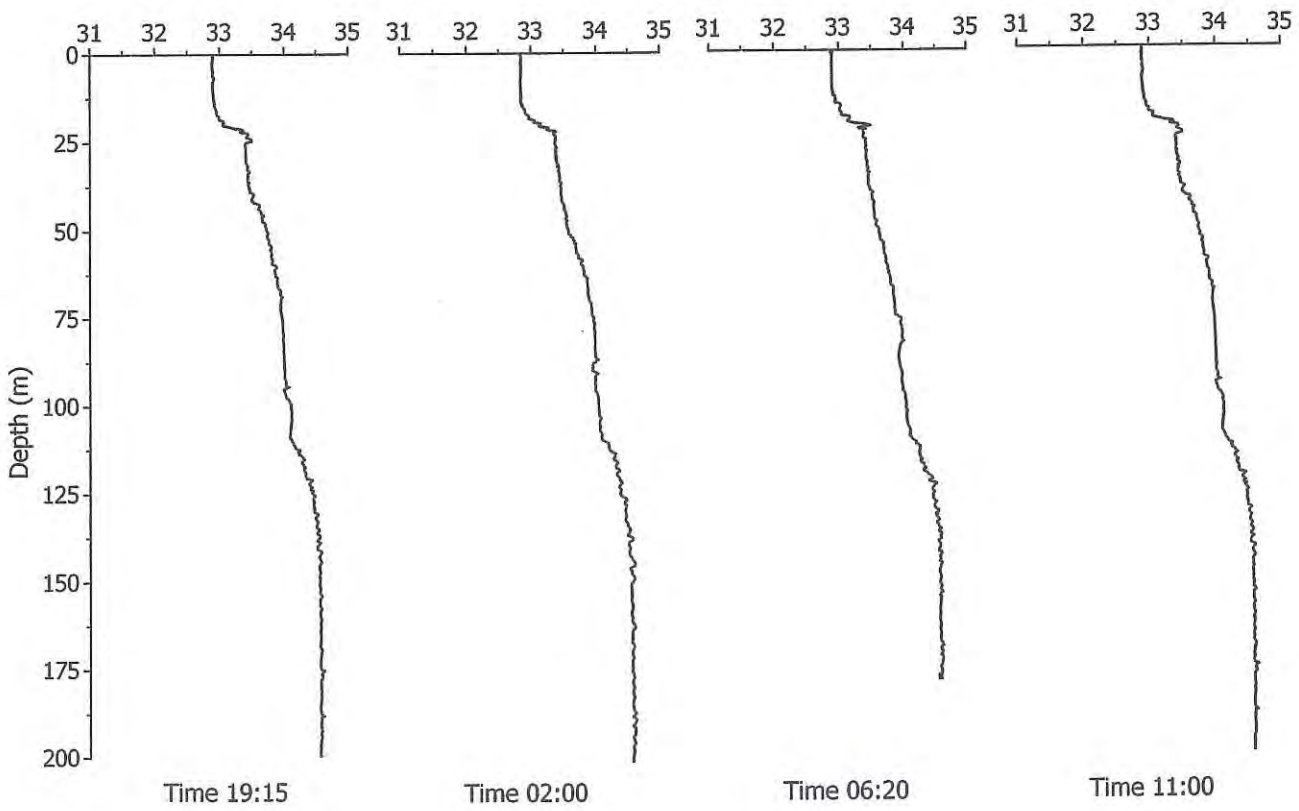
Temperature (°C)  
Time Series St. No.19



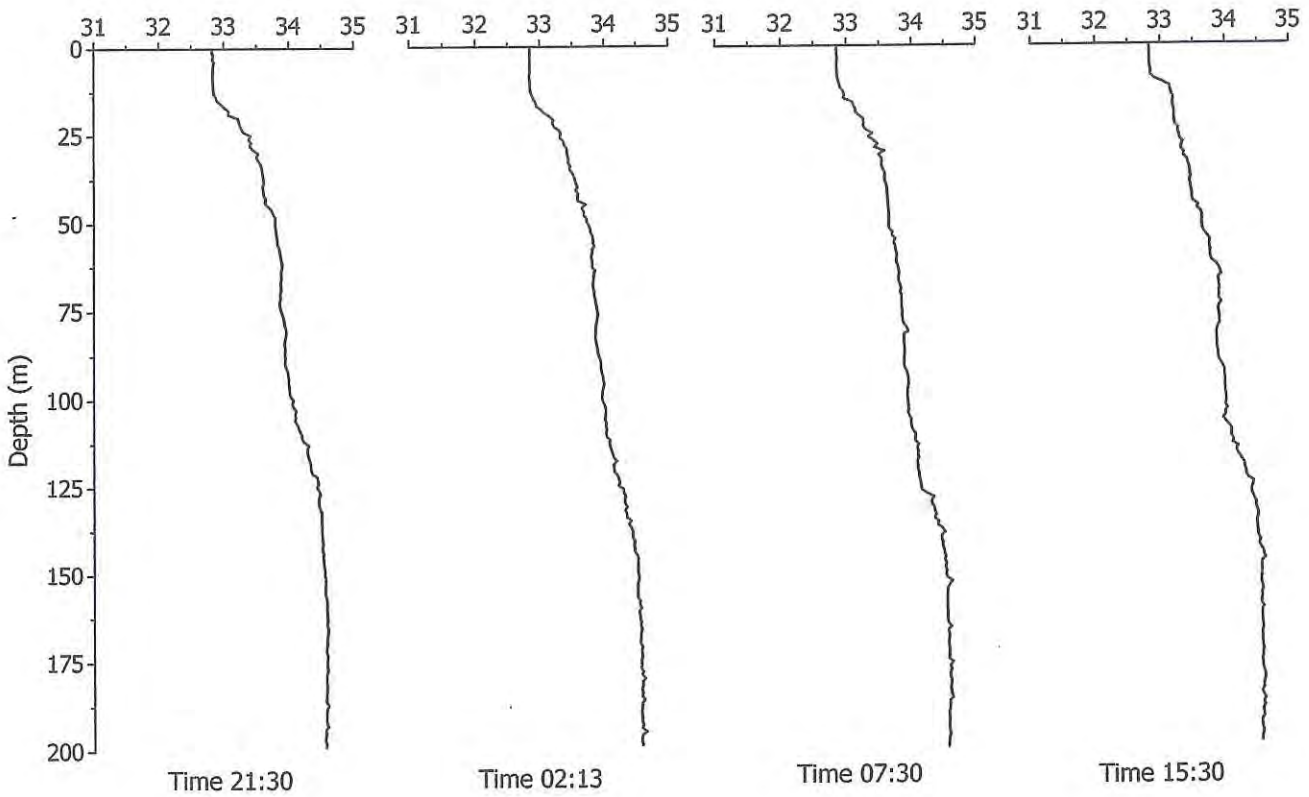
Time Series St.No.21



Salinity (PSU)  
Time Series St. No.19

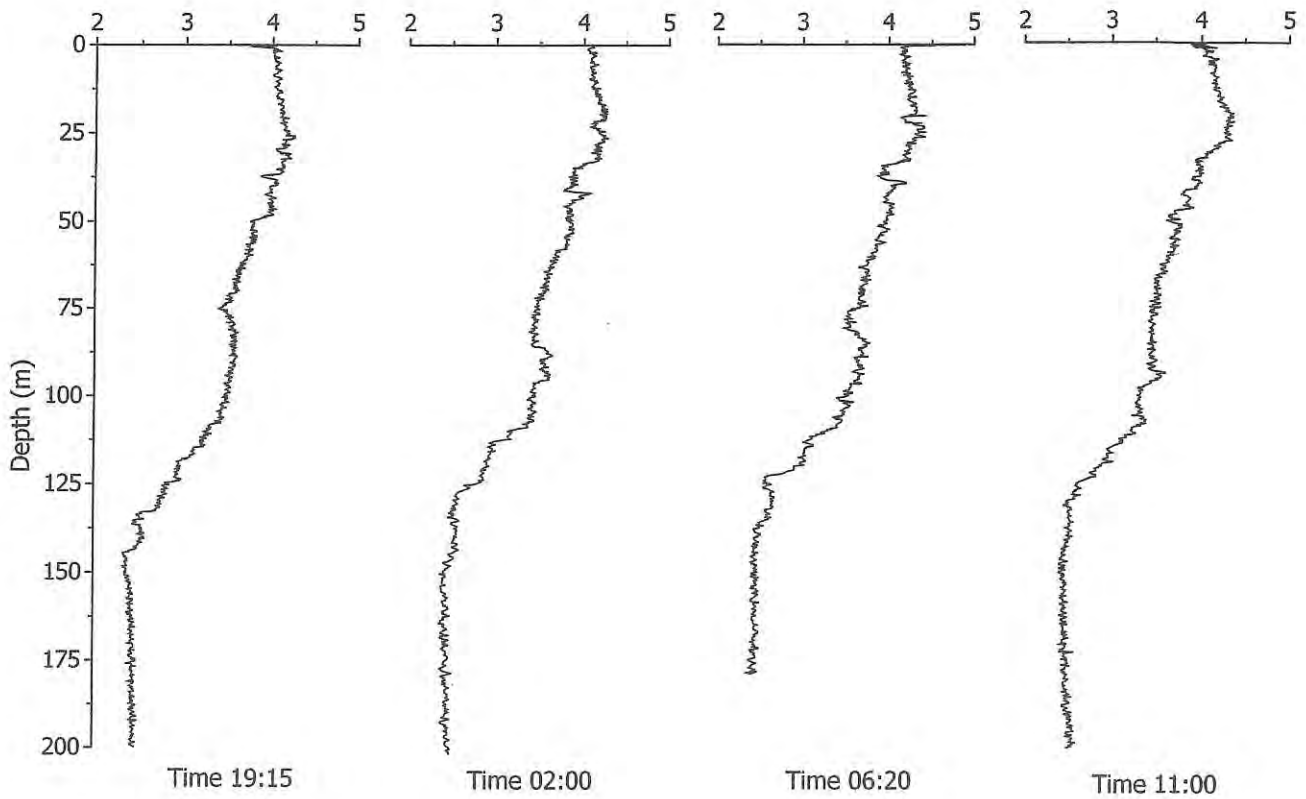


Time Series St.No.21

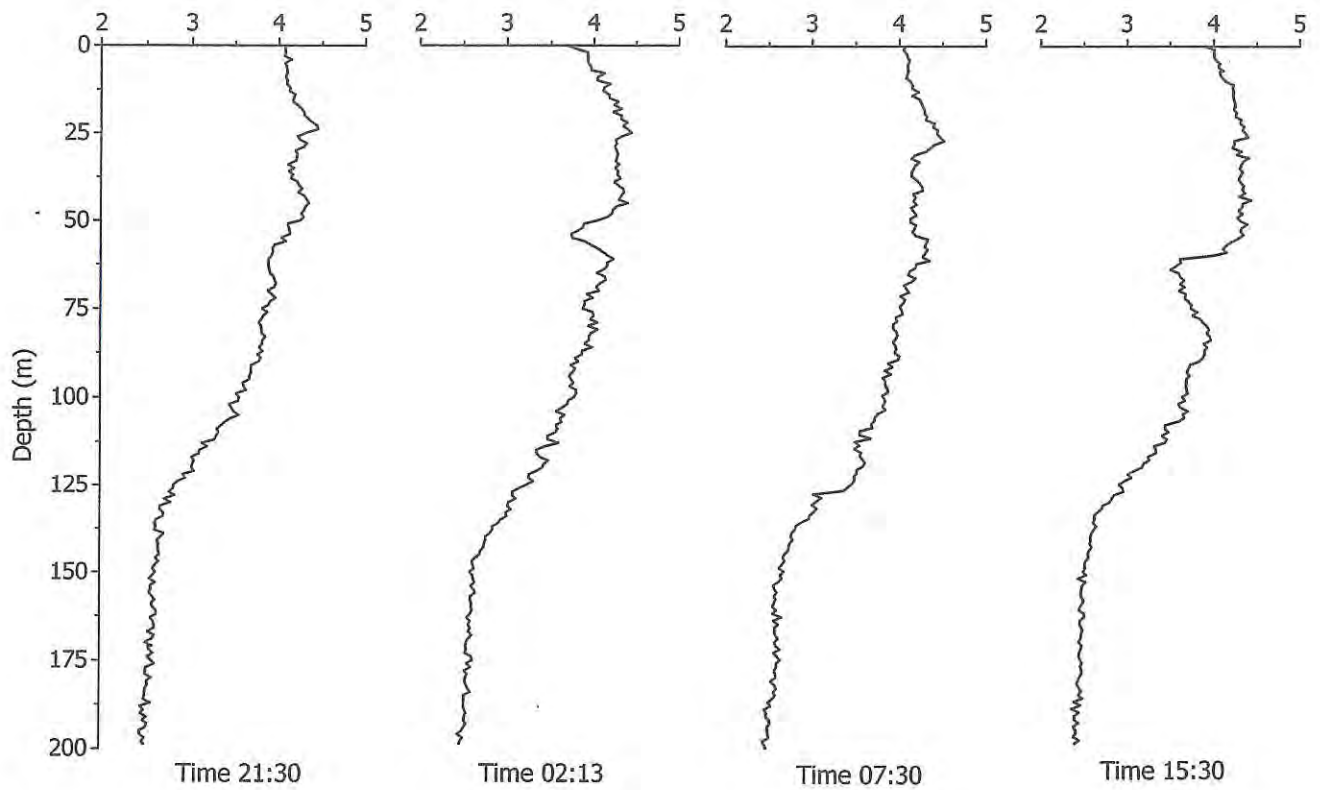




Oxygen (ml/l)  
Time Series St. No.19

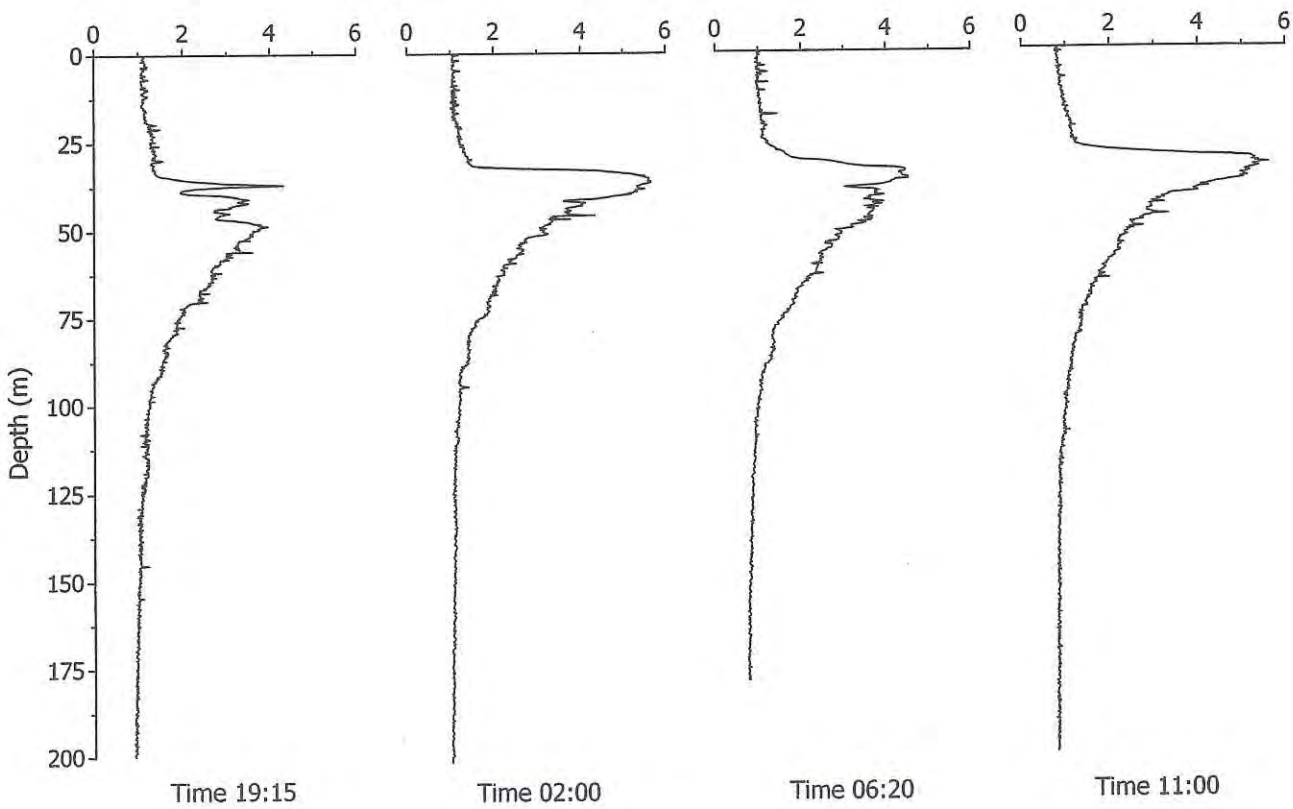


Time Series St.No.21



Chlorophyll (ml/l)

Time Series St. No.19



Time Series St.No.21

