

SK 252 Tropical Indian Ocean Programme

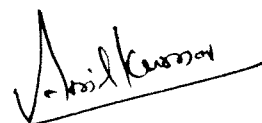


Cruise report

16th November to 13th December 2008

ACKNOWLEDGEMENT

We the scientific team of SK 252 onboard Sagar Kanya are grateful to the Secretary, Ministry of Earth Sciences for the immense help provided by him for the successful execution of this northeast monsoon cruise programme of Tropical Indian Ocean studies. We are thankful to Director NCAOR and Dr. Sudhakar [GD OSSG] for their constant support for successful implementation of this expedition. We thank the Captain, all SCI Officers and crew members onboard Sagar Kanya for the proper navigation of the vessel which helped us for collecting all required samples and data at the pre planned station locations along the cruise track. We are thankful to the catering officer and all his staff for serving us tasty and homely food. We thank NORINCO engineers for the service provided by them in operating all the required scientific equipments onboard for the successful completion of this cruise.



[N. ANILKUMAR]

CHIEF SCIENTIST

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1. Embarkation

Sagar Kanya sailed from Chennai port on 16th November 2008 at 05:00 hrs after the embarkation of all scientists and crew members onboard. A pre cruise meeting was held onboard including all Scientists, Ship Officers and Norinco engineers for discussing the operations to be carried out in the predefined cruise track.

2. Objectives and expected results

1. A comprehensive understanding of the physical, chemical, and biological aspects of the tropical Indian Ocean. Studies related to the Equatorial Current system, Water masses and Zonal transport are the key importance of this investigation.
2. To understand the nutrient chemistry of the study region from the water samples collected from different depths.
3. The meteorological archive will be useful for a comprehensive understanding of the climatic variabilities.
4. To determine the total quantity of chlorophyll by spectrophotometric method.
5. To study the abundance of zooplankton.
6. To determine total bacterial biomass
7. Microbial studies.
8. Studies on diatoms

For understanding the biogeochemistry of the tropical Indian Ocean a detailed data collection was planned at one degree latitude from 18°S including water sample collection from different depths.

These all data archive will be useful for detailed approach to understand the climatic variabilities

3. Participating organizations

1. NATIONAL CENTRE FOR ANTARCTIC & OCEAN RESEARCH (NCAOR)
2. UNIVERSITY OF ALLAHABAD
3. NORINCO

4. List of participants

Sl. No	NAME	Organization
1	Dr. N. Anilkumar (Chief Scientist)	NCAOR
2	Dr. Zeena Jayan	NCAOR
3	Ms. Racheal Chacko	NCAOR
4	Ms. Sharon Bibiana Noronha	NCAOR
5	Mr. Shramik Maruti Patil	NCAOR
6	Mr. Vyom Parashar	Allahabad University
7	Mr. Tindel Dipeshkumar	NCAOR [Ship trainee]
8	Mr. Sameer Shaikh	NCAOR [Ship trainee]
9	Mr. K. Madhusudan	NORINCO
10	Mr. Avertino Callistus Luis	NORINCO
11	Mr. N. Dhanashekar	NORINCO
12	Mr. E. Vasantharaj	NORINCO
13	Mr. K. R. Perumal	NORINCO

5. Equipments operated

- 1) Single beam Echo sounder
- 2) Conductivity Temperature Depth [CTD] with rosette samplers
- 3) Portable CTD
- 4) Expendable Bathythermograph (XBT)
- 5) Automatic Weather Station
- 6) Meteorological observations
- 7) Acoustic Doppler Current Profiler
- 8) Sub-bottom Profiler

6. Diary of Events

16/11/2008

Sea surface temperature (SST), Sea surface salinity (SSS) and Meteorological observations were made at 3 hourly intervals. XBT observations were carried out at 1°Latitude interval. AWS, ADCP and SBP were switched on.

17/11/2008

All synoptic observations were made at regular intervals. XBT probes were launched at 1° latitude interval.

18/11/2008

Launching of XBT probes and synoptic observations were made as per the schedule.

19/11/2008 - 25/11/2008

All synoptic observations were carried out at regular intervals. XBT probes were launched at 1° latitude interval. Expected arrival of the first station at 18°S 65 °E will be during 0600 hrs on 26th November 2008.

26/11/2008

Arrived at the 1st CTD station [18°S 65 °E] at 0605 hrs. CTD casts were made for physical, chemical and biological parameters. Water samples were collected upto 1000m depth. Synoptic observations were carried out at regular intervals. Arrived at Station 2 [17°S 65 °E] at 2115 hrs. CTD operations were carried out for all hydrographical parameters. Water samples were collected upto 1000m depth for biological and chemical analysis.

27/11/2008

Arrived at Station 3 [16°S 65 °E] at 1230 hrs. CTD operations were made for water sample collection and profiles for hydrographic parameters. Vessel sailed from Station 3 at 1840 hrs.

28/11/2008

Arrived at Station 4 [15°S 65 °E] at 0310 hrs. CTD operations were carried out. At all the above stations (Stations 1 to 4) Idronaut and Portable CTDs were operational. Portable CTD was used for deeper cast. Synoptic observations were made at regular intervals. Idronaut and portable CTD was operated at Station 5 [14°S 65 °E] during 1540 hrs.

29/11/2008

Idronaut and portable CTD operations were carried out at Station 6 [13°S 65 °E] and 7 [12°S 65 °E]. Water samples were collected upto 1000m for chemical and biological analysis. Vessel sailed from Station 7 at 2340 hrs.

30/11/2008

Vessel arrived at Station 8 at 0700 hrs. Both Idronaut and portable CTD operations were carried out. Vessel started sailing from station 8 [11°S 65 °E] at 1235 hrs. Arrived at Station 9 [11°S 65 °E] at 1915 hrs. Multiple plankton net operation was carried out. Both the CTD operations were carried out for hydrographic parameter and water sample collection. Synoptic observations were carried out at regular intervals.

01/12/08

Vessel left from 10°S at 0300 hrs. CTD observations and water sample collections were made at 9°S. SST, SSS and met observations were being carried out at regular intervals. Vessel sailed from 9°S at 1645 hrs.

02/11/2008

Arrived at 8°S at 0000 hrs. Water samples collection and CTD observations were carried out at this station. Vessel left this station at 0800 hrs. All the above operations were carried out at 7°S also. Synoptic data collection was made at regular intervals.

03/11/2008

CTD operations and water sample collection were made at 6°S and 5°S. Multiple Plankton Net was operated at 5°S. SST, SSS and surface met observations were carried out.

04/11/2008

Water sample collection and CTD observations were at made at 4°S and 3°S. Synoptic observations were also carried out at regular intervals.

05/11/2008

Vessel arrived at 2°S at 0915 hrs. CTD observations along with water sample collection were carried out. Vessel left the station at 1345 hrs and arrived at 1°S at 2030 hrs. All the above data and sample collection was made. Synoptic observations are being carried out at regular intervals.

06/11/2008

Water sample collection and CTD observations were made at equator and 1°N along the transect. As per the schedule SST, SSS and met observations are being made.

07/11/2008

Vessel arrived at 2°N at 0245 hrs. CTD observations and water sample collection was carried out. Vessel left the station at 0630 hrs. At 3°N also the above said observations were made. Synoptic observations were being carried out at regular intervals. Vessel arrived at 4°N at 2140 hrs. CTD observations and water sample collection were completed at 0200 hrs (08/08/2008)

08/11/2008

The vessel reached the next station 5°N at 0830 hrs. CTD observations and water sample collection along with Multiple Plankton Net operations were carried out. The station came to an end at 1225 hrs. Vessel proceeded to the next station 6°N for carrying out similar observations and reached location at 1850 hrs.

09/11/2008

Stations at 7°N and 8°N were carried out. CTD observations and water sample collection was carried out at both the locations. Synoptic observations were also carried out at regular intervals.

10/11/2008

The ship reached station 9°N at 0125 hrs. After completion of CTD observations and water sample collection, the vessel sailed from the station at 0415 hrs and proceeded to the next station. Reached Station 10°N at 1130 hrs. Sailed from the station at 1700 hrs after completion of observations. MPN observation was carried out at 10° 02 'N and 65° 07'E. Firing of XBT's was resumed at one degree interval. After completion of all stations vessel started heading towards Goa.

11/11/2008

Synoptic observations along with SST, SSS observations were carried out at regular intervals. Launching of XBT probes were made as per the schedule.

12/11/2008

Synoptic observations along with SST, SSS observations were carried out at regular intervals.

13/08/2008

Vessel arrived Goa at 1115 hrs.

7. Physical Observations

The results obtained from the hydrographic data (XBT, CTD) collected in the tropical Indian Ocean during November-December, 2008 when compared to the previous studies will be attributed to the significant annual changes occurring in the upper ocean thermal structure and variation in the boundary of the equatorial current system and its east west transport in the equatorial region.

8. Chemical oceanographic studies

The data collected during this expedition will be used to understand the nutrient chemistry of the study region from the water sample collected from different depths.

Procedure:

Water sample collection began from 18°S and is continuing at every one degree interval along the same longitude 65°E.

The water samples were taken from the following depths:

0, 10, 20, 30, 50, 60, 75, 100, 120, 150, 180, 200, 300, 500, 750 and 1000m respectively.

Soon after the collection pH and Dissolved Oxygen (D.O. (ml/L)) analysis were carried out. Samples are stored in the freezer for nutrient analysis Autoanalyser (SKALAR).

The results obtained from the data could be helpful to understand the variation in nutrients, dissolved oxygen and the chemical characteristics of water masses in the Tropical Indian Ocean.

9. Biological observations

The data collected from this expedition shall be used to understand the biological aspects of tropical Indian Ocean during northwest monsoon. This study may enlighten the total quantity of chlorophyll, abundance, viability, culturability, luminescence and their tolerance to different manganese concentrations of bacteria. The water samples collected

shall be used to prepare samples for ATP analysis and microscopic studies using diatoms obtained from the said samples. The data collected will be useful to study the vertical distribution of chlorophyll during study period. Trace metal data will be useful to know the amount of trace metals present in the ocean.

Studies on diatoms: The stations covered are—18°S, 16°S, 13°S, 10°S, 7°S, 4°S, 1°S, 1°N, 4°N, 7°N, and 10°N along 65°E. At each station total 15L sea-water from different depths viz. 10m, 20m, 30m, 40m, 50m, 60m, 70m, 80 and 100m was collected. The total volume of sea water was mixed in a bucket and was filtered out using 0.45 micron meter membrane and was kept in filtered 300 ml sea water.

Further the diatoms will be isolated from the samples collected onboard. Characterization of diatoms silica shells will be done using facilities at Nanophosphor Application Centre, University of Allahabad viz. PL spectroscopy, AFM, Raman Spectroscopy, SEM, HRTEM, to understand the composition, morphology and optical properties of diatom silica shell. Nanoindentation will be performed to evaluate the mechanical strength of silica shell. Silica shell will be coated with nanophosphors and the optical properties will be studied.

10. Observational procedure:

For chlorophyll: Water samples collected from Latitude 18°S along 65°E longitude from surface, 10m, 20m, 30m, 50m, 60m, 75m, 100m, 120m, 150m, 180m, 200m depths by Strickland and Parsons standard procedure for chlorophyll estimation (Practical handbook of seawater analysis, 1968).

For Microbiological studies: Water sample collected up to 12 depths viz. surface, 10m, 20m, 30m, 50m, 60m, 75m, 100m, 120m, 150m, 180m, 200m. 5 ml sample will be preserved with buffered formalin for direct count of bacteria, 100 µl samples plated on Nutrient agar plates (25% NB + 2% AA) and 100 µl on manganese 1mM concentration plate to get manganese tolerant bacteria from the ocean. 200 ml sample is kept in Cool place for further microbiological analysis.

For trace metal analysis: Water samples (1L) collected at 3 depths viz. 10m, 100m, and 200m in clean, sterilized bottle and preserved with 20% ultrapure Nitric acid.

For ATP analysis: Water samples were collected through Niskin Bottles up to 12 depths viz. surface, 10m, 20m, 30m, 50m, 60m, 75m, 100m, 120m, 150m, 180m and 200m depths and filtered through 0.22µ filter paper and kept in freezer for further analysis.

Zooplankton studies: Collection of zooplankton samples that aid to describe prevalent biological diversity variations along the 65 ° E North-South transect.

Sample type: Zooplankton, collected with Multi-Plankton Net hauled vertically. Depth intervals: 0-100, 100-200, 200-300, 300-400 m, Mesh size : 200 microns. Samples were transferred into 500 ml containers and preserved in buffered formalin solution for later examination and identification

11. Cruise track

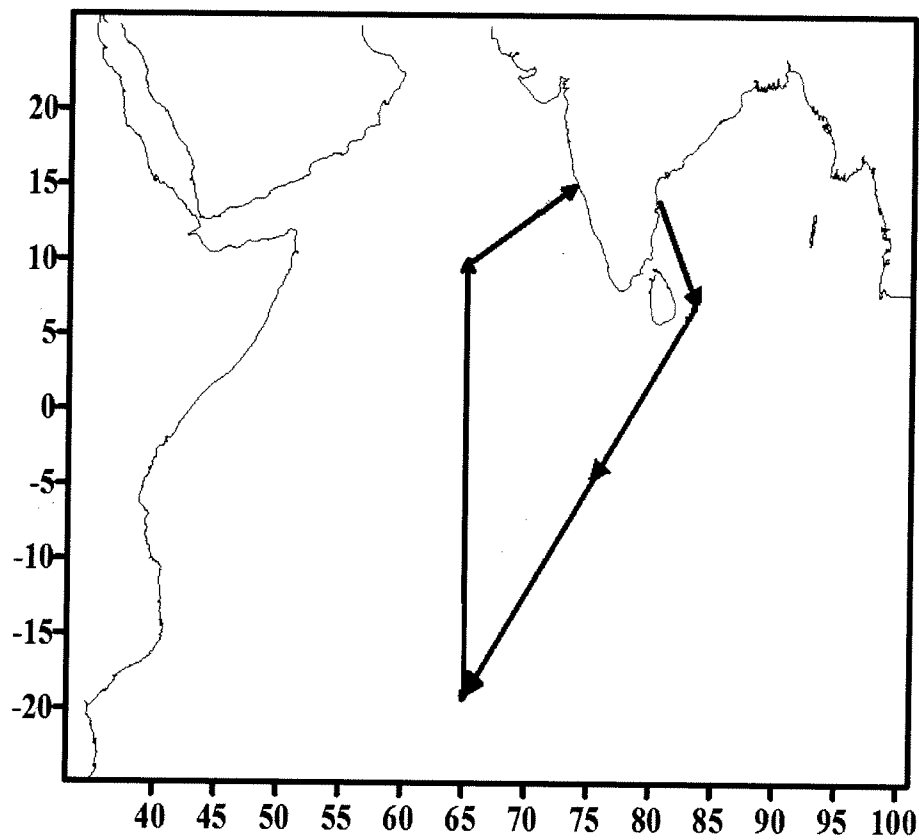


Fig. 1 Cruise track along which CTD, XBT and MPN

12. Station Locations

Station No	Date	Latitude	Longitude	Depth	Time of Arrival	Time of Departure	Operations Carried Out
1	26-11-2008	18 S	65 E	2700	06:40	12:50	Idronaut, PCTD, Water Sample Collection
2	26-11-2008	17 S	65 E	3787	21:00	05:00 (27-11-08)	Idronaut, PCTD, Water Sample Collection
3	27-11-2008	16 S	65 E	3200	12:30	18:40	Idronaut, PCTD, Water Sample Collection
4	28-11-2008	15 S	65 E	3600	03:00	07:45	Idronaut, PCTD, Water Sample Collection
5	28-11-2008	14 S	65 E	3500	15:40	20:50	Idronaut, PCTD, Water Sample Collection
6	29-11-2008	13 S	65 E	3600	04:00	10:00	Idronaut, PCTD, Water Sample Collection
7	29-11-2008	12 S	65 E	3200	18:00	23:40	Idronaut, PCTD, Water Sample Collection
8	30-11-2008	11 S	65 E	3900	06:30	12:35	Idronaut, PCTD, Water Sample Collection
9	30-11-2008	10 S	65 E	3600	20:00	02:45 (01-12-08)	Idronaut, PCTD, Water Sample Collection, MPN
10	01-12-2008	09 S	65 S	4265	10:15	16:30	Idronaut, PCTD, Water Sample Collection
11	02-12-2008	08 S	65 S	4300	00:00	07:40	Idronaut, PCTD, Water Sample Collection
12	02-12-2008	07 S	65 S	4200	14:45	20:50	Idronaut, PCTD, Water Sample Collection
13	03-12-2008	06 S	65 S	4300	03:40	13:15	Idronaut, PCTD, Water Sample Collection
14	03-12-2008	05 S	65 S	4100	20:15	02:00 (04-12-08)	Idronaut, PCTD, Water Sample Collection, MPN
15	04-12-2008	04 S	65 S	4100	09:10	14:00	Idronaut, PCTD, Water Sample Collection
16	04-12-2008	03 S	65 S	4000	21:30	02:25 (05-12-08)	Idronaut, PCTD, Water Sample Collection
17	05-12-2008	02 S	65 E	4200	09:40	13:35	Idronaut, PCTD, Water Sample Collection
18	05-12-2008	01 S	65 E	4100	20:40	00:05 (05-12-08)	Idronaut, PCTD, Water Sample Collection
19	06-12-2008	00	65 E	3800	07:05	10:50	Idronaut, PCTD, Water Sample Collection, MPN
20	06-12-2008	01 N	65 E	3619	17:30	20:45	Idronaut, PCTD, Water Sample Collection

Station No	Date	Latitude	Longitude	Depth	Time of Arrival	Time of Departure	Operations Carried Out
21	07-12-2008	02 N	65 E	2496	03:00	06:15	Idronaut, PCTD, Water Sample Collection
22	07-12-2008	03 N	65 E	2600	12:30	15:50	Idronaut, PCTD, Water Sample Collection
23	07-12-2008	04 N	65 E	3335	22:30	01:45 (08-12-08)	Idronaut, PCTD, Water Sample Collection
24	08-12-2008	05 N	65 E	3200	08:30	12:25	Idronaut, PCTD, Water Sample Collection, MPN
25	08-12-2008	06 N	65 E	3200	18:50	22:15	Idronaut, PCTD, Water Sample Collection
26	09-12-2008	07 N	65 E	3300	04:30	08:05	Idronaut, PCTD, Water Sample Collection
27	09-12-2008	08 N	65 E	4645	15:00	18:30	Idronaut, PCTD, Water Sample Collection
28	10-12-2008	09 N	65 E	4000	01:25	04:15	Idronaut, PCTD, Water Sample Collection
29	10-12-2008	10 N	65 E	4450	11:30	17:00	Idronaut, PCTD, Water Sample Collection, MPN
30	10-12-2008	10 02 N	65 07 E				MPN

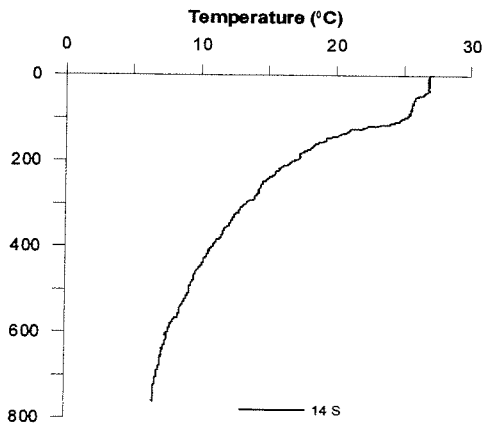
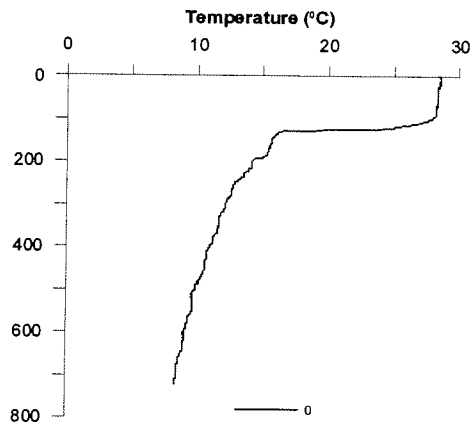
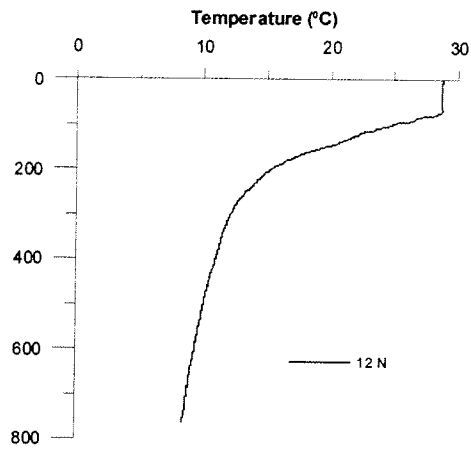
XBT Locations

Date	Time	Latitude	Longitude	Depth	SST
16/11/2008	12:30	12 N	080 44.13 E	3026	28.5
	19:00	11 N	081 09.33 E	3430	28
17/11/2008	00:50	10 N	081 30.82 E		28
	06:10	09 N	081 52.71 E	3264	28
	11:55	08 N	082 15.85 E	3336	29
	17:00	07 N	082 16.38 E	3133	28.5
	22:00	06 N	082 02.51 E	3361	28.5
18/11/2008	03:45	05 N	081 21.00 E	3302	28
	10:20	04 N	080 49.58 E	3332	29
	17:30	03 N	080 13.10 E	3208	29
19/11/2008	00:40	02 N	079 35.73 E	3155	28.5
	08:30	01 N	078 57.14 E	3224	28.5
	17:15	0	078 19.18 E	3235	28
20/11/2008	03:00	01 S	077 40.41 E	3200	27.5
	12:40	02 S	077 03.18 E	3439	27.5
	22:30	03 S	076 24.03 E	3374	27.5
21/11/2008	08:30	04 S	075 45.40 E	3310	27.5
	18:20	05 S	075 07.69 E	2001	28
22/11/2008	03:23	06 S	074 28.84 E	5000	
	11:15	07 S	073 50.66 E	1924	28
	18:40	08 S	073 09.06 E	4000	28.5
23/11/2008	02:25	09 S	072 20.83 E	2000	28.5
	08:50	10 S	071 41.59 E	1500	29
	18:25	11 S	070 44.08 E	2387	29
24/11/2008	03:05	12 S	069 56.00 E	3516	27.5
	11:25	13 S	069 07.80 E	3656	27
	19:45	14 S	068 18.07 E	2500	27
25/11/2008	04:30	15 S	067 29.21 E	3039	26
	13:30	16 S	066 39.95 E	3352	26.5
	21:50	17 S	065 50.90 E	3314	26
26/11/2008	17:30	17 28 S	064 56.57 E	3293	26

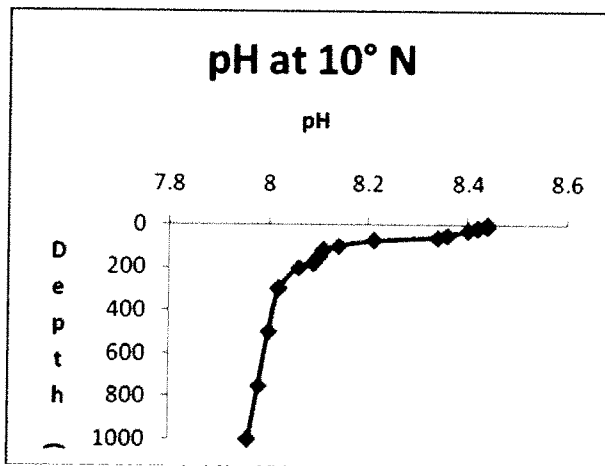
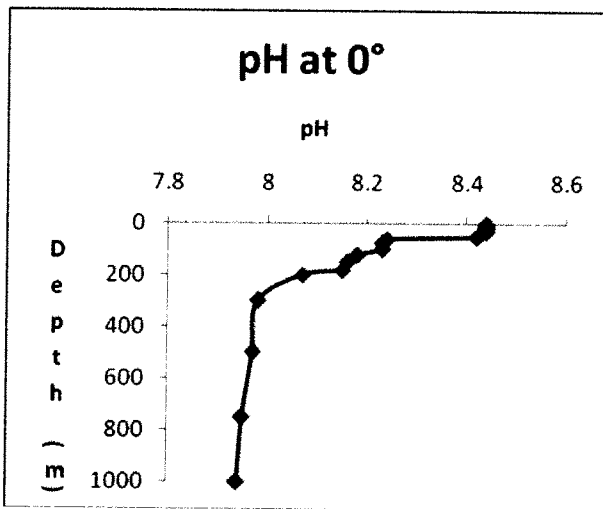
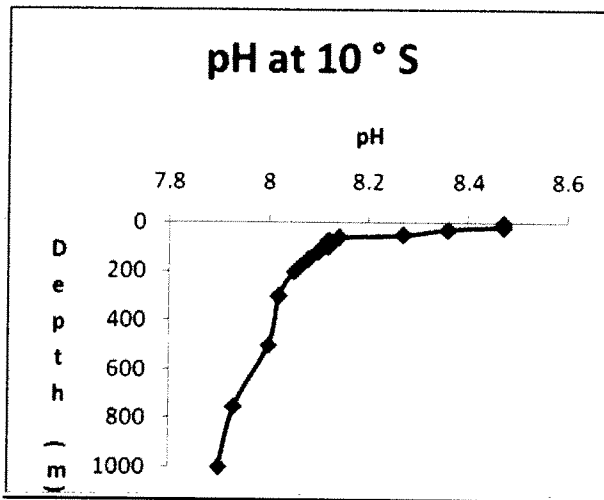
Biological Observations

Sl. No	Latitude	Longitude	Observations
1	18S, 16S, 14S, 12S, 10S, 8S, 6S, 4S, 2S, 0, 2N, 4N, 6N, 8N, 10N.		Samples collected for chlorophyll, Plate count of bacteria, direct count of bacteria, ATP analysis and Trace metal analysis.
2	17S, 15S, 13S, 11S, 9S, 7S, 5S, 3S, 1S, 1N, 3N, 5N, 7N, 9N.	65E	Samples collected for chlorophyll, Plate count of bacteria, direct count of bacteria and ATP analysis.
3	10S, 5S, 0, 5N, 10N	65E	Collection of zooplankton samples that aid to describe prevalent biological diversity variations.

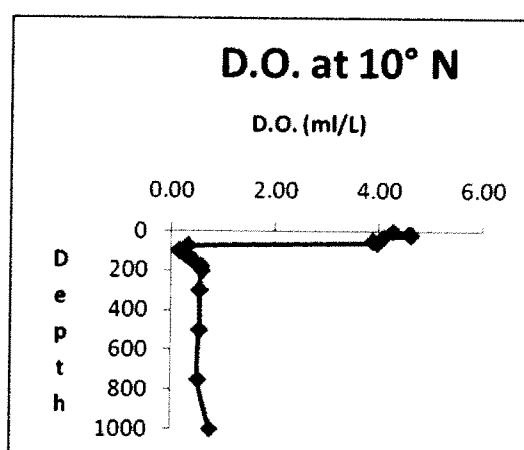
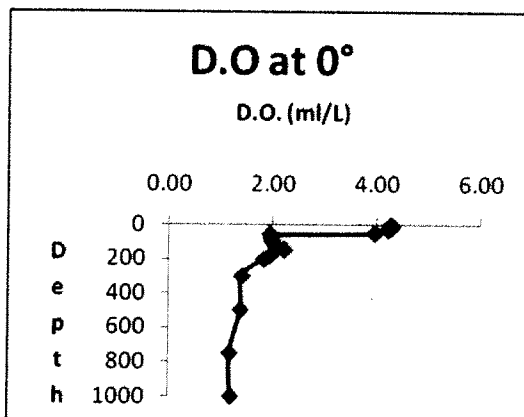
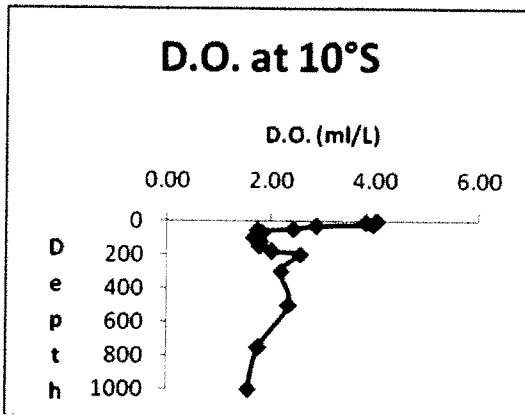
13. Figures



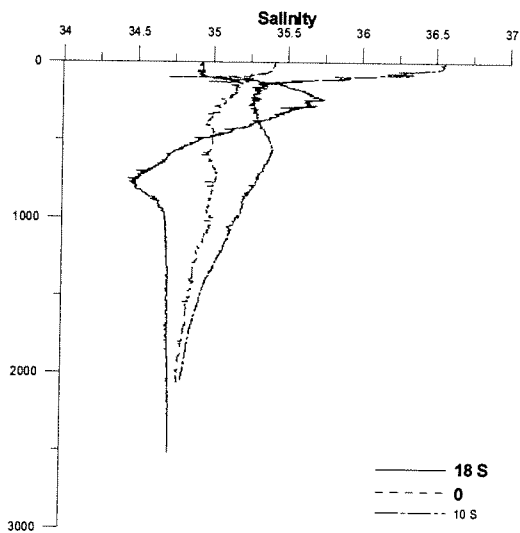
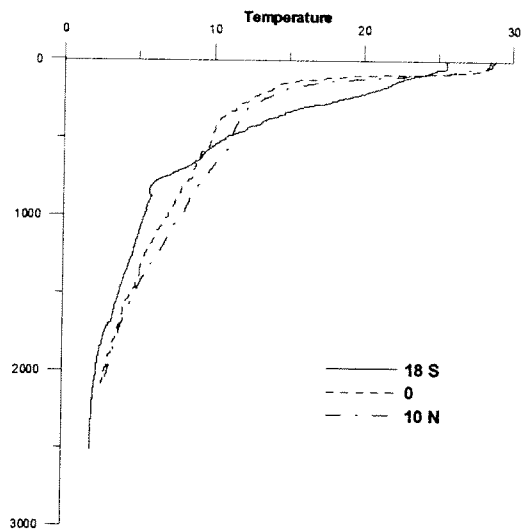
XBT profiles from various latitude



Vertical profiles for pH at various locations



Vertical profiles for DO at various locations



Temperature and Salinity profiles from different latitudes