

# CRUISE REPORT



राष्ट्रीय समुद्र विज्ञान  
संस्थान

**NATIONAL INSTITUTE  
OF  
OCEANOGRAPHY**

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**ORV SAGAR KANYA**  
**CRUISE 220**  
(10 May - 8 June, 2005)

**NATIONAL INSTITUTE OF**  
**OCEANOGRAPHY**  
(Council of Scientific and Industrial Research)  
Dona Paula, Goa 403004

# REPORT ON CRUISE 220 OF ORV SAGAR KANYA

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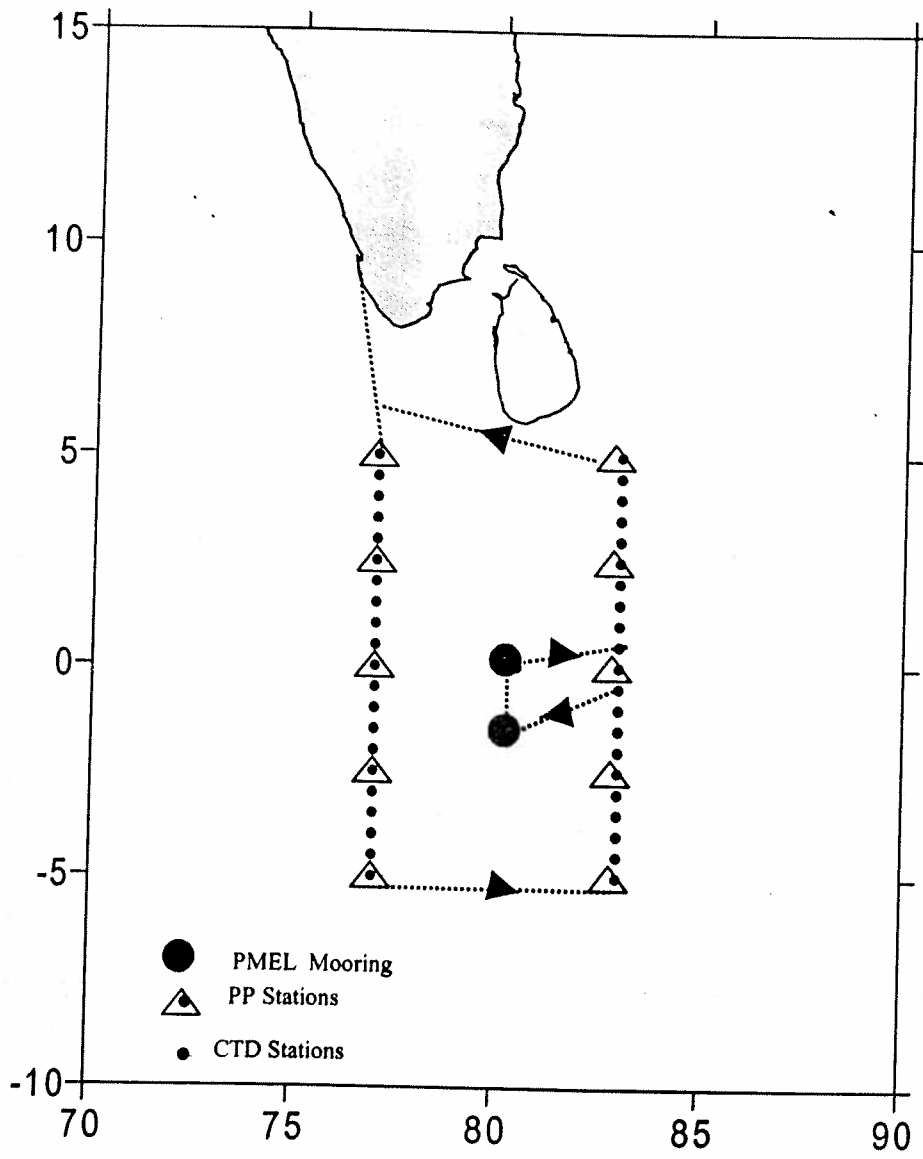
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## 1. SUMMARY

The 220<sup>th</sup> cruise of ORV *Sagar Kanya* sailed from Kochi on 10<sup>th</sup> May 2005 and returned back to Kochi on 8<sup>th</sup> June 2005. This is the first of the four cruises planned in the Equatorial Indian Ocean under the DOD funded programme of Oceanic processes of the equatorial Indian Ocean (GAP-1402) to address the seasonal variability of the upper ocean in response to atmospheric forcing and its implication to overall biogeochemistry. The *in situ* measurements in this cruise are designed to capture the spring inter-monsoon (pre-monsoon) signature. The measurements were of two types: underway and *in situ*. Acoustic Doppler Current Profiler (ADCP), was used for the under way measurement. For *in situ* measurements, the CTD was operated at half-a-degree interval along two transects along 77°E and 83°E from 5°N to 5°S with 12 L and/ 5 L GoFlo bottles. Water samples for the analysis of chemical parameters were collected by operating the CTD twice (usually 1000-150 m and 120-1 m). Similarly there were two separate casts for Primary Productivity (PP) and <sup>15</sup>N based new production rate measurements (up to 150 m). Multiple Plankton Net (MPN) was hauled up from 1000 m to surface with intermittent closing/opening of individual nets usually from 1000-500, 500-300, 300-200 (below thermocline), 200-50 (thermocline) and from 50 to surface (mixed layer). To achieve *in situ* conditions for PP measurements, the PP mooring assembly with samples from 10 different depths after adding tracer substrates- was deployed before day-break and recovered after sun set from ten pre-decided stations. A sediment core was collected from 4373 m at 5°S and 83°E. A total of six Argo floats were deployed at six pre-determined locations. Hands-on training on oceanographic data collection and analysis was given to 14 Marine Science students of Goa University.

## 2. CRUISE TRACK



### 3. INTRODUCTION

The 220<sup>th</sup> cruise of ORV *Sagar Kanya* is the first of the four cruises planned in the Equatorial Indian Ocean under the DOD funded programme of Oceanic processes of the equatorial Indian Ocean (GAP-1402) to address the seasonal variability of the upper ocean in response to atmospheric forcing and its implication to overall biogeochemistry. The *in situ* measurements in this cruise are designed to capture the spring inter-monsoon (pre-monsoon) signature. The measurements were of two types: underway and *in situ*. Acoustic Doppler Current Profiler (ADCP), was used for the under way measurement. For *in situ* measurements, the CTD was operated at half-a-degree interval along two transects along 77°E and 83°E from 5°N to 5°S with 12 L and/ 5 L GoFLo bottles. Water samples for the analysis of chemical parameters were collected by operating the CTD twice (usually 1000 - 120 m and 100 - 1 m). Similarly there were two separate casts for Primary Productivity (PP) and <sup>15</sup>N based new production rate measurements (up to 150 m). Multiple Plankton Net (MPN) was hauled up from 1000 m to surface with intermittent closing/opening of individual nets usually from 1000-500, 500-300, 300-200 (below thermocline), 200-50 (thermocline) and from 50 to surface (mixed layer). To achieve *in situ* conditions for PP measurements, the PP mooring assembly with samples from 10 different depths after adding tracer substrates- was deployed before day-break and recovered after sun set from ten pre-decided stations.

### 4. ITINERARY

Departure: Kochi, 10 May 2005

Arrival: Kochi, 8 June 2005

## 5. CRUISE PARTICIPANTS

### 5.1 Scientific component

1. Dr. S. Prasanna Kumar, Chief Scientist	National Inst. of Oceanography
2. Dr. Sugandha Sardesai	-do-
3. Dr.V.V.Gopalakrishna	-do-
4. Dr. Mangesh Gauns	-do-
5. Mr. Nuncio Murukesh	-do-
6. Ms. Jayu Narvekar	-do-
7. Ms. Deepti .M	-do-
8. Ms. Vera Rodrigues	-do-
9. Ms. Venecia Catul	-do-
10. Ms. Maya Varkey	-do-
11. Ms. Karen Lobo	-do-
12. Mr.Satya Prakash	PRL
13. Ms. Sruthi Kumar	Goa University
14. Ms. Tanvi Vaidyanathan	-do-
15. Mr. Phadte Vinay	-do-
16. Mr.Shetye S. Suhas	-do-
17. Ms. Noronha Sharon B	-do-
18. Ms. Gaonkar Pradnya P.	-do-
19. Ms. Badesab Shahin Kadar	-do-
20. Mr. Naik Sagar Ankush	-do-
21. Ms. Dhargalker Supriya M.	-do-
22. Ms. Shet Soniya M.	-do-
23. Ms. Sawant Mrinal	-do-
24. Ms. Bhosle Vinupriya S.	-do-
25. Mr. Naik Tuyenkar Parag P.	-do-
26. Ms. Nambiar Reshma K.	-do-
27. Mr. Samant Darshan	-do-
28. Mr. Biju V.Nair	NORINCO
29. Mr. K. Anantha Krishnana	-do-
30. Mr. M.L. Syedali	-do-
31. Mr. M. Girish Yellappa	-do-

### 5.2 Ship's complement

1. CAPT. K.S. Pandyan	Master
2. Mr. Satyendra Pratap	Chief Officer
3. Mr. Kalyan Singh	2 <sup>nd</sup> Officer
4. Mr. D. Chakraborty	2 <sup>nd</sup> Officer
5. Dr. P.G. Ramda	Medical Officer
6. Mr. Shankar Menon	RO
7. Mr. P.H. Bhagavandas	Purs. Officer
8. Mr. G.N. More	CEO
9. Mr. S. Mandal	2 <sup>nd</sup> EO
10. Mr. Haridharan Das	4 <sup>th</sup> EO
11. Mr. Kazi Abdur Rob	4 <sup>th</sup> EO
12. Mr. M.P. Chezhiyan	4 <sup>th</sup> EO
13. Mr. P. Dhananjoy	EL/O
14. Mr. Freddy Furtado	Catg. Officer
15. Mr. Kannan Kumar	A/Catg. Officer

## 6. OBJECTIVES

1. To obtain a high-resolution biogeochemical measurements along two trans-equatorial sections along 78°E and 83°E from 5°N to 5°S to decipher spatial variations in physical, chemical and biological properties as a part of the seasonal cycle and the various forcing that are responsible for such variability in the equatorial Indian Ocean.
2. To visit the PMEL Ocean-Atmosphere mooring deployed at the equator during November 2004.
3. Collection of one sediment core from 5°S and 93°E.
4. Deploy Argo floats at pre-determined locations.
5. Training of Marine science students of Goa University on oceanographic data collection and analysis.

## 7. WORK ACCOMPLISHED

### 7.1 Parameters measured

1. Temperature profile
2. Salinity profile
3. Sea surface temperature (SST)
4. Wind speed and direction
5. Air temperature and wet bulb temperature
6. Atmospheric pressure
7. Current speed and direction (ADCP)
8. Chlorophyll *a*
9. <sup>14</sup>C based Primary production rate
10. <sup>15</sup>N based new production
11. Phytoplankton
12. Mesozooplankton
13. Microzooplankton
14. Bacterial abundance
15. TEP counts and concentration
16. Dissolved oxygen
17. TCO<sub>2</sub>
18. pH
19. Alkalinity
20. Nutrients (Nitrate, Phosphate)
21. TOC

### 7.2 Instrument and machinery used onboard

1. CTD with Rosette (Sea-Bird)
2. I-Dronaut CTD
3. 5L Niskin samplers
4. ADCP
5. AUTOSAL
6. Echo sounder
7. Multiple Plankton Net
8. Metrohm titration unit
9. Milli Q water purification system
10. Jib boom
11. Atlas crane
12. CTD winch
13. Deep sea winch
14. Piston corer

### 7.3 NIO equipment used onboard

1. Coulometer
2. pH meter
3. Spectrophotometer
4. Gas Chromatograph
5. Filtration units and pumps
6. 12 L GoFlo water samplers 12 numbers
7. PP Mooring system
8. Fluorometer
9. Sea-Bird conductivity sensor



#### 7.4 ADCP operation

ADCP was switched on for underway measurement on 10<sup>th</sup> May 2005 at 1930 hrs after crossing 50 m depth contour from the Kochi port towards the open ocean transect. ADCP data was collected along the tracks, 77°E and 83°E.

#### 7.5 Surface met observations

Surface met observations were carried out along both the track at each station.

#### 7.6 CTD operations

Sea-Bird CTD was operated at half-a-degree interval up to 1000 m depths to collect temperature and salinity profiles along 77°E and 83°E (see cruise track). Data was collected during down cast while water samples were collected during up cast. At each of the PP stations water samples were collected using CTD Rosette for 2 casts for nutrient measurements, 1 cast each for zooplankton, PP, <sup>15</sup>N based new production measurements.

#### 7.7 MPN operations

MPN was operated with flow meter sensor. Depth sensor was used to determine the closing depth of the net. In all 5 nets were operated to make stratified collection up to 1000 m. MPN was hauled up from 1000 m to surface with intermittent closing/opening of individual nets usually from 1000-500, 500-300, 300-200 (below thermocline), 200-50 (thermocline) and from 50 to surface (mixed layer).

#### 7.8 In situ primary production measurements

In situ primary production measurements were carried out by inoculating the samples drawn from CTD rosette from 10 depths (upper 150 m) by <sup>14</sup>C and deploying it in situ with the help of PP mooring. In all 10 PP stations were occupied, 5 along 77°E and 5 along 83°E.

#### 7.9 <sup>15</sup>N based new production measurements

New production measurements were carried out using isotopically (<sup>15</sup>N) enriched tracers of Nitrate, Ammonia and Urea at all the PP stations (5 along 77°E and 5 along 83°E).

#### 7.10 Piston core operation

Sediment core was collected using piston core from a water depth of 4373 m at 5°S and 83°E. The length of the core was about 3.5 m

#### 7.11 Deployment of Argo floats

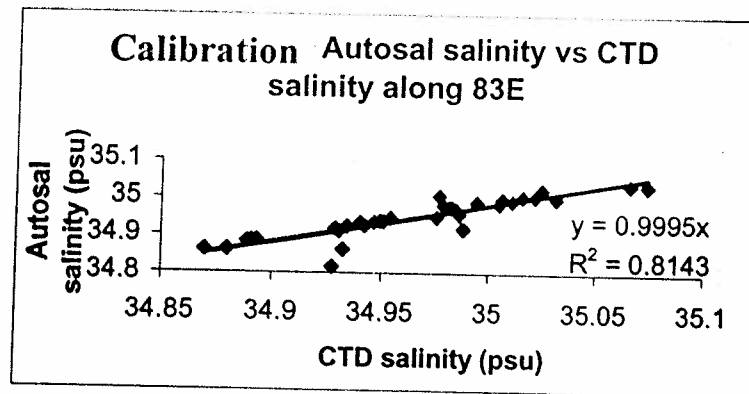
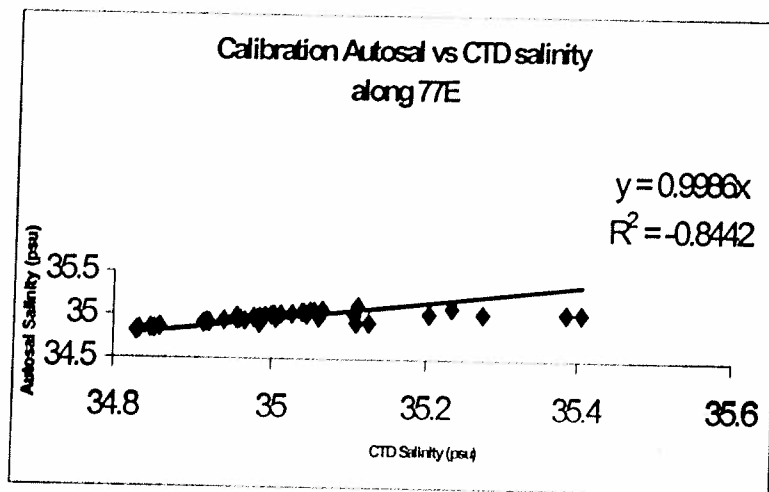
In all 6 Argo floats were deployed during the cruise at pre-determined locations and the details are given below:

Float ID	Date	Time (IST)	Latitude N/S	Longitude E
1828	13 May 2005	0035 hrs	5 19.58N	76 58.32E
1833	25 May 2005	1950 hrs	4 53.87S	82 51.86E
1832	27 May 2005	2340 hrs	2 00.17S	82 51.86E
1829	29 May 2005	2345 hrs	0 01.66N	80 32.79E
1831	1 June 2005	1615 hrs	1 59.64N	83 01.42E
1830	5 June 2005	0455 hrs	5 03.47N	83 05.13E

## 8. PERFORMANCE OF THE EQUIPMENT USED

### *Sea-Bird CTD - calibration of CTD salinity with Autosol salinity*

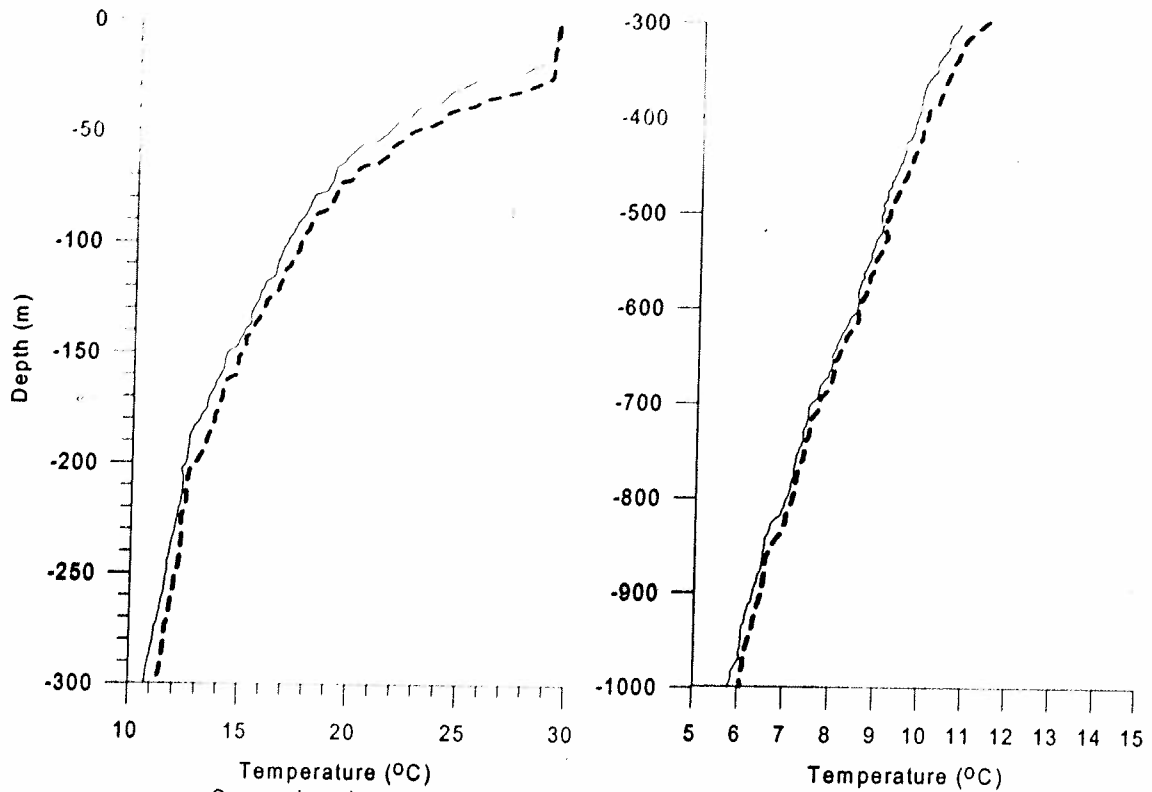
As the Sea-Bird CTD onboard did not have a conductivity sensor, the Sea-Bird conductivity sensor brought from NIO was connected to it. The salinity from the conductivity sensor was calibrated with water samples collected from 600 m, 800 m and 1000 m depth and salinity estimated with the help of onboard Autosol. In all 36 samples from 12 locations along 77°E and 34 samples from 12 locations along 88°E were used to calibrate the CTD salinity with Autosol salinity. The regression for both transects (along 77°E and 83°E) is given in the below figures separately.



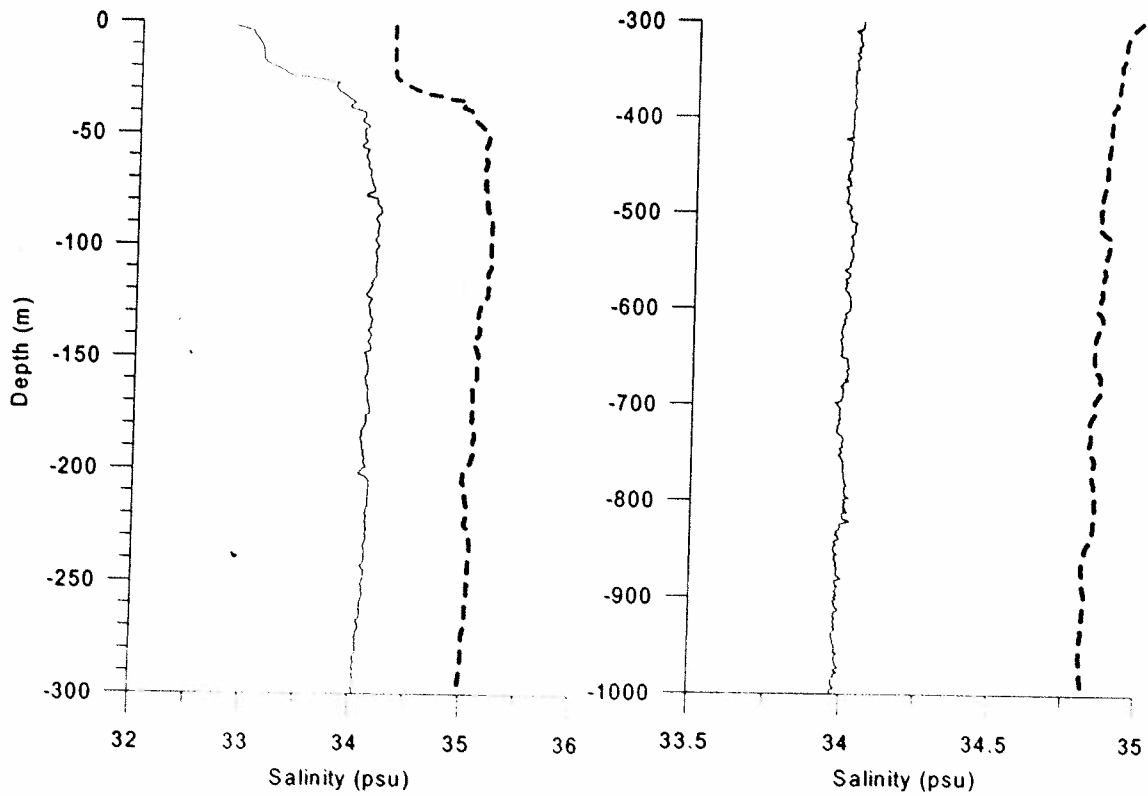
### *Comparison between Sea-Bird CTD and Idronaut CTD*

Though the Sea-Bird CTD along with the Rosette was used extensively for acquiring the temperature salinity profiles and collection of water samples, a comparison was made between the Sea-Bird CTD and onboard IDRONAUT CTD by operating both at the same station 5°N and 77°E (CTD\_21) on 21<sup>st</sup> May 2005 at 1320 hrs.

Comparison between IDRONAUT CTD and SEABIRD CTD  
CTD\_21 Lat: 5 S Long: 77 E SST: 29.4 C Time: 1320 hrs.  
Date: 21-05-2005



Comparison between IDRONAUT CTD and SEABIRD CTD  
CTD\_21 Lat: 5 S Long: 77 E SST: 29.4 C Time: 1320 hrs.  
Date: 21-05-2005



It is obvious from the above plots that there exist a substantial difference between the Sea-Bird CTD and the IDRONAUT CTD for both temperature and conductivity sensors, more severe for later.

### ***CTD Rosette***

The CTD Rosette was working only for 11 bottle positions. Very often though the triggering indicated closing of bottles at positions 6, 8 and 12, when the CTD comes up they did not close and hence resulted in loss of sample. As there were not enough spares such as rubber chord, o-rings, sockets, crimping mechanism, vineyards etc. were not available for GoFlo bottles, rectification of the problem was not effective.

### ***Hydrographic winch***

Hydrographic winch developed winding problem during the course of the operation. Hence subsequent operations of lifting of MPN net were carried out manually.

### ***Multiple Plankton Net***

In general multiple plankton net worked very well. But some times there were incidents when the net did not close due to malfunctioning, which was later rectified for subsequent operations.

### ***Auto analyzer***

The auto analyzer was used to analyze nitrite/nitrate, but the phosphate and silicate analysis was not possible due to malfunction.

## **9. PERFORMANCE OF THE SHIP**

In general, the shipboard machinery and equipment worked satisfactorily but the major problem encountered was with air-conditioning system. The air-conditioning in the labs, specially chemistry lab, dry port lab, dry starboard lab, wet port lab, wet starboard lab, photography lab (Autosal lab) was not functioning as lab temperature were 30°C most of the time. Due to this chemical analysis and several other analysis have to be shifted from their designated place to labs which were cooler such as Gravimeter room, multi-purpose lab etc. In some labs additional fans were fitted to give more ventilation thereby reducing the temperature marginally.

The living rooms and the recreation room of scientists and the chief scientist's cabin were very hot throughout the cruise. Apart from this, bedbugs infested most of the cabins. The top panels and porthole frames of several cabins were rusted and were in a very bad shape. This sometime resulted in water leakage.

## **10. LOSS REPORT**

Two 12 L GoFlo bottles belonging to NIO was damaged during the course of the operation.

200 m of CTD cable was cut at CTD\_26 station (3°S, 83°E) on 26<sup>th</sup> May 2005 at 1645 hrs as the CTD developed electrical fault in the cable.

## 11. CONCLUSIONS

Data was collected at all the planned stations.

1. All 43 stations were covered for various observations and data collection.
2. ADCP data was collected along both the track, i.e, along 77°E and 83°E.
3. CTD was operated at half-a-degree interval up to 1000 m depth along 77°E and 88°E.
4. Nutrients and chlorophyll a measurements were carried out at one-degree interval along 77°E and 88°E. However, near the equator the sampling was carried out at half-a-degree spatial interval.
5. <sup>14</sup>C based primary production measurement were carried in-situ at 10 stations, 5 each along 77°E and 88°E.
6. <sup>15</sup>N based new production measurements were carried out at all the 10 PP stations.
7. One piston core was operated at a water depth of 4373 m location at 5°S and 83°E.
8. The PMEL TAO buoy at 1.5°S and 80.5°E was located without mast on 29 May 2005 at 1045 hrs.
9. The second PMEL TAO buoy at equator and 80.5°E was located with mast (but without light) on 29<sup>th</sup> May 2005 at 2225 hrs.
10. 6 Argo floats were deployed at pre-determined positions.

## 12. RECOMMENDATIONS

- AS most of the multidisciplinary cruise needs large volume of water sample it is important to have sufficient number of (at least 12+5 spare) 12L GoFlo.
- samplers along with spare parts like rubber chords, crimping equipment and accessories, vineyards, etc.
- Vacuum pump and filtration unit being a common facility used by chemists, biologists and geologists, at least 3-4 sets must be available for continuous operation.
- Most of the 30L GoFlo bottles are damaged/needs replacement. It is recommended that 2 sets of 30L bottles (12 × 2 = 24 nos).
- Present CTD Rosette needs urgent repair/replacement some of the studs on which water samplers are to be hooked are either damaged or non functional.
- The cooling in the dry port lab and conference room is not satisfactory. Additional AC unit may augment this.
- An LCD projector and a PC may be made available permanently at the conference room to facilitate talks, seminars and discussions.

## 13. ACKNOWLEDGEMENTS

Master, Chief Engineer, Chief Officer, all other Officers as well as the entire shipboard personnel from deck, engine and catering departments cooperated very well to make this cruise a great success. The Chief Scientist and the entire team record their appreciation for this co-operation.

Similarly, the ELQOME engineers extended their technical support whenever required.

The constant encouragement by the Director, NIO and the excellent logistical support extended by Dr. M. Sudhakar and NCAOR team is greatly acknowledged.

Equatorial project team acknowledges the funding support by the Department of Ocean Development, Government of India for carrying out this measurement programme.

**Appendix I**

**Table 1 - Station locations and operations**

Sl. No.	Station number	Latitude N/S	Longitude E	Date	Time IST	Operations	
1	CTD_01	5° 20'N	76° 57' E	12-5-05	0410	<b>Transect along 77°E</b> PP cast up to 150 m N15 cast up to 150 m Micro-Zoo up to 150 m PP mooring deployment PP mooring recovery CTD deep cast up to 1000 m CTD Shallow cast up to 100 m MPN up to 1000 m Deployment of Argo float ID1828	
		5° 19'N			13-5-05		0035
2	CTD_02	4° 29'N	77° 00' E	13-5-05	0600		CTD deep cast up to 1000 m
3	CTD_03	3° 59'N	77° 00' E	13-5-05	1045 1200 1310		CTD Deep cast up to 1000 m MPN up to 500 m CTD shallow cast 100 m
4	CTD_04	3° 30'N	77° 00' E	13-5-05	0710		CTD deep cast up to 1000 m
5	CTD_05	3° 00'N	77° 00' E	13-5-05 14-5-05	2220 0005		CTD deep cast up to 1000 m CTD shallow cast up to 300 m.
6	CTD_06	2° 31' N	76° 59' E	14-5-05	0415 0515 0610 1830		PP cast up to 150 m N15 cast up 101 m PP mooring deployment PP mooring recovery CTD deep cast up to 1000 m MPN up to 500 m CTD shallow cast up to 150 m
			77° 00' E	15-5-05	0020 0140 0245		
7	CTD_07	2° 01'N	77° 00' E	15-5-05	0730		CTD deep cast up to 1000m
8	CTD_08	1° 30'N	77° 00' E	15-5-05	1315 1440 1605		CTD deep cast up to 1000 m MPN up to 1000m CTD shallow cast up to 150 m
9	CTD_09	1° 0'N	77° 00' E	17-5-05	1310 1435	CTD deep cast up to 1000 m CTD shallow cast up to 300 m	
10	CTD_10	0° 29'N	77° 00' E	17-5-05	1830 2000 2127	CTD deep cast up to 1000 m MPN up to 1000 m CTD shallow cast up to 120 m	
11	CTD_11	0° 0'N	77° 00' E	16-5-05	0505 0605 0615	PP cast up to 150 m <sup>15</sup> N cast up 125 m PP mooring deployment CTD deep cast up to 1000 m MPN up to 1000 m CTD shallow cast up to 100 m	
				17-5-05	0225 0442 0705		
12	CTD_12	00° 29'S	77° 00' E	18-5-05	0545 0700	CTD deep cast up to 1000 m MPN up to 1000 m	

13	CTD_13	00° 59'S	77° 00' E	18-5-05	0810 1250 1425	CTD shallow cast up to 120 m CTD deep cast up to 1000 m CTD shallow cast up to 200 m
14	CTD_14	2° 30'S	76° 59'E	19-5-05	0117 0215 0305 0405 0455 0555 1830	CTD deep cast up to 1000 m MPN up to 1000 m CTD shallow cast up to 300 m PP cast up to 150 m N15 cast up to 152 m PP mooring deployment PP mooring recovery
15	CTD_15	1° 29'S	77° 00' E	20-5-05	0030 0145 0225	CTD deep cast up to 1000 m MPN up to 1000 m CTD shallow cast up to 200 m
16	CTD_16	2° 0'S	77° 00' E	20-5-05	0637	CTD deep cast up to 1000 m
17	CTD_17	3° 0'S	76° 59' E	20-5-05	1450 1540 1640	CTD deep cast up to 1000 m MPN up to 1000 m CTD shallow cast up to 120 m
18	CTD_18	3° 29'S	76° 59'E	20-5-05	2037	CTD deep cast up to 1000 m
19	CTD_19	3° 59'S	76° 59'E	21-5-05	0130 0220 0300	CTD deep cast up to 1000 m MPN up to 1000 m CTD shallow cast up to
20	CTD_20	4° 30'S	76° 59'E	21-5-05	0735	CTD deep cast up to 1000m
21	CTD_21	5° 00'S	76° 59'E	21-5-05  22-5-05	1220 1320 1415 1447 0010 0405 0505 0545 1830	Deep cast Sea Bird CTD Idronaut CTD up to 100 m Shallow cast up to 200 m MPN up to 2500 m MPN up to 1000 m PP cast up to 150 m N15 cast up to 115 m PP mooring deployment PP mooring recovery
22	CTD_22	04° 49'S  05° 00'S  04° 53'S	83° 00' E  83° 00' E  82° 51' E	24-5-05  25-5-05 25-5-05	0740 0915 1035 1100 0015 0330 0430 0510 1833 1950	<b>Transect along 83°E</b> CTD deep cast up to 1000 m CTD shallow cast up to 800 m CTD shallow cast up to 60 m Piston core operation MPN up to 1000 m PP cast up to 150 m N15 cast up to 160 m PP mooring deployment PP mooring recovery Deployment of Argo float ID 1833
23	CTD_23	4° 29' S	83° 00' E	25-5-05	1700	CTD deep cast up to 1000 m
24	CTD_24	04° 00'S	83° 59' E	26-5-05	0220 0315 0410	Deep cast up to 1000 m MPN up to 1000 m Shallow cast up to 120 m
25	CTD_25	3° 30'	83° 0'	26-5-05	0808	Deep cast 1000 m
26	CTD_26	3° 0'	82° 59'	26-5-05	1300	Deep cast 1000 m

					1400 1645	MPN up to 1000 m Shallow cast 120 m (Due to electrical problem of CTD cable operation was halted at 1445 200m CTD cable was out and reconnected. Operation resumed at 1645. (1445 – 1645) )
27	CTD_27	02° 29'	82° 59'	26-5-05	2120 2220 2340 0335	Deep cast up to 100 m Shallow cast up to 120 m MPN up to 1000 m PP cast up to 150 m
		02° 30'	83° 0'	27-5-05	0430 0500 0530 1815 2340	PP cast up to 120 m NIS cast up to 130 m PP deployment PP recovery Deployment of ARGO float ID 1832
28	CTD_28	02° 00'	82° 59'	27-5-05	2240	Deep cast upto 1000 m
29	CTD_29	01° 29'	82° 59'	28-5-05	0320 0410 0515	Deep cast up to 1000 m MPN up to 1000m Shallow cast up to 150 m
30	CTD_30	01° 00'	82° 59'	28-5-05	0915 1040	Deep cast up to 1000 m Shallow cast up to 300 m
31	CTD_31	00° 30'	83° 00'	28-5-05	1445 1545 1645 1045	Deep cast up to 1000 m MPN up to 1000 m Shallow cast up to 120 m [TAO buoy without mast was sighted at position 01° 29' S 80° 29' E Took Photograph]
32	CTD_32	01° 29'	80° 27'	29-5-05	1110	Deep cast up to 1000 m [Tao Buoy with mast (but without light) was first sighted on the screen of Radar at 2210hr on 29-5-05. Location of Bouy LAT: 00° 01' N LONG: 80° 31' E] [Sighted by eye near the ship under searchlight at 2225 hr]
33	CTD_33	00° 50' N	80° 32' E	29-5-05	2245 2345	Deep cast up to 1000m Deployment of ARGO float ID 1829
34	CTD_34	00° 29' N	83° 00' E	30-5-05	1615 1720 1810	Deep cast up to 1000 m MPN up to 1000 m Shallow cast up to 120 m
35	CTD_35	00° 00' S	83° 00' E	30-5-05  31-5-05	2155 2250 2355 0335 0430 0515 1815	Deep cast up to 1000 m MPN up to 1000 m Shallow cast up to 200 m PP cast up to 150 m NIS upto 130 m PP deployment PP Recovery



36	CTD_36	00° 59' N	83° 00' E	01-6-05	0325 0425	Deep cast up to 1000 m Shallow cast up to 200 m
37	CTD_37	01° 30' N	83° 00' E	01-6-05	0840 0945 1050	Deep cast 1000 m MPN up to 1000 m Shallow cast up to 150 m
38	CTD_38	01° 59' N	83° 00' E	01-6-05	1515 1615	Deep cast up to 1000 m Deployment of ARGO float ID 1831
39	CTD_39	02° 29' N	83° 00' E	01-6-05  02-6-05	2005 2055 2150 0340  0600 1820	Deep cast up to 1000 m MPN up to 1000 m Shallow cast up to 120 m PP cast up to 150 m N15 cast (Suspended due to strong wind, rain and rough weather) PP deployment PP recovery
40	CTD_40	03° 00' N	83° 00' E	03-6-05	0130 0430 0450 0725	Deep cast up to 1000 m Shallow cast up to 120 m MPN up to 1000 m N15 cast up to 115 m
41	CTD_41	03° 30' N	83° 00' E	03-6-05	1140	Deep cast 1000 m
42	CTD_42	04° 00' N	83° 00' E	03-6-05	1600 1730 1930	Deep cast up to 1000 m MPN up to 1000 m Shallow cast up to 120 m
43	CTD_43	05° 00' N  05° 00' N  05° 03' N	83° 00' E  83° 00' E  83° 05' E	04-6-05  05-6-05	0225 0410 0515 1830 0200 0300 0405 0455	PP Cast up to 150 m N15 Cast up to 120 m PP deployment PP recovery Deep cast up to 1000 m MPN up to 1000 m Shallow cast up to 500 m Deployment of ARGO float ID 1830