Report on Oceanographic Cruise of O. R. V. Sagar Kanya

CRUISE No. 61

17th January to 6th February, 1991

National Institute of Oceanography
Dona Paula–403 004, Goa
INDIA

NATIONAL INSTITUTE OF OCEANOGRAPHY
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Dona Paula, Goa - 403 004

REPORT ON

61ST OCEANOGRAPHIC CRUISE OF

O.R.V. SAGAR KANYA

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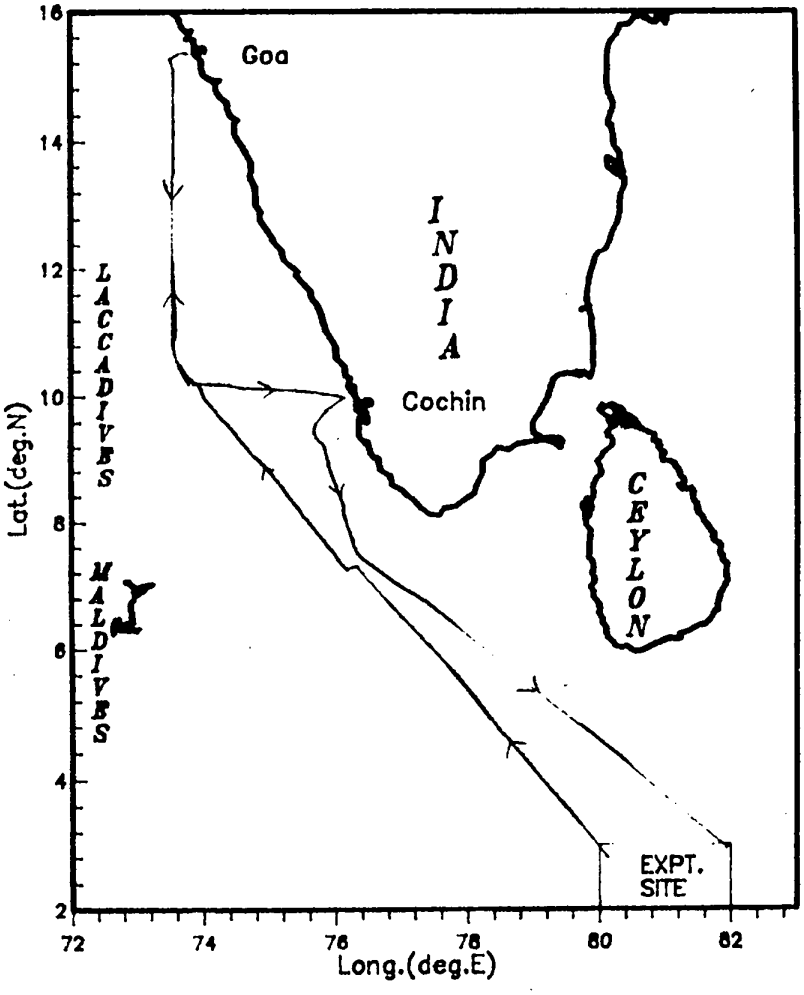
C O N T E N T S

61 Voyage of ORV SAGAR KANYA – Cruise track.
017–036 1991 p nio



2. CRUISE SUMMARY

The 61st cruise of ORV SAGAR KANYA was planned as a part of Indian participation in the "Heard Island Experiment" proposed by Prof. W.H. Munk of Scripps Institution of Oceanography, U.S.A. to establish the feasibility of monitoring the global ocean warming due to Green-house effect using acoustic techniques. The ship sailed off from Mormugao harbour on 17 January, 1991 and returned to the same harbour on 6 February, 1991. The transmitter was located at about 40 km SE of Heard Island (53.2°S, 73.1°E) at a depth of 150 m from the surface and transmitted four different types of signals viz., continuous wave (CW) and pseudo random coded sequences. The acoustic receptions of these signals were made at the location 3°N, 82°E using a hydrophone suspended from a drifting buoy (1000 m)/ sonobuoy (300 m) between 24th to 31st January, 1991.

The proposed work consisted of

a) Laying of one deep sea mooring consisting of 4 current meters and 1 acoustic noise recorder near Kalpeni Island to obtain data on currents and receive acoustic signals from Heard Island in the presence of ambient noise;

b) Collection of environmental data through use of CTD system;

c) To carry out acoustic receptions at 3°N, 82°E, by deploying a surface drifting buoy/sonobuoys with a hydrophone suspended into the sound channel and following its trajectory for the period of transmission.

3. PARTICIPANTS

a) Scientific Component

J.S. Sastry	-	Chief Scientist (Mormugao-Cochin)
C.S. Murty	-	Chief Scientist (Cochin-Mormugao)
Y.K. Somayajulu	)	
S. Prasanna Kumar	)	
T.V. Ramana Murty	)	
A.K. Saran	)	Physical Oceanography Division
A.M. Almeida	)	
G.S. Navelkar	)	
P.V. Chodankar	)	
N.M. Anand	)	
K. Ashok Kumar	)	Ocean Engineering Division
P. Pednekar	)	
M.C. Pathak	)	
K.C. Kotnala	)	Geological Oceanography Division
O. Vijaya Kumar	-	NPOL, Cochin
P.S. Swati	-	NAL, Bangalore
Werner Morawitz	-	SIO, U.S.A. (Representative of Project Investigator Prof. W.H. Munk).

Vijayakumar Patil	)	
N.M. Subramanyam	)	
Ganesh Chandvale	)	
Nizu Paul	)	Onboard Trainees
Mathew David	)	
Pramod Kumar U.B.	)	
Muralidharan	)	

b) Ship's Complement

Capt. R.D. Sudarshan	-	Master
K.K. Gard	-	C/Off.
M. Satheesh Kumar	-	AWKO
O.J. Shoby	-	TNO
V. Mohanraj	-	Cadet
G.S. Nagarcenkar	-	C/R/Off.
K.G. Varghese	-	R/Off.
D.S. Murty	-	Med/Off.
S. Suresh Kumar	-	Purser
H.N. Shewale	-	C/E/Off.
A.P. Lagvankar	-	2/E/Off.
Shivaji Singh	-	3/E/Off.

A. Mukhopadhyay	-	4/E/Off.
J. Pratap	-	5/E/Off.
V.G. Nair	-	El/Off.
M. Dias	-	El/Off.
M. Fernandes	-	Ctr/Off.

4. OBJECTIVES

The main objective of the cruise was to evaluate the ocean variability and acoustic reliability through long distance sound propagation.

5. CRUISE DETAILS

All participants joined the ship at 1100 hrs. on 17th January, 1991. The vessel sailed from Mormugao harbour at 1810 hrs. on the same day. The ship arrived at the mooring location near Kalpeni Island at 2330 hrs. on 18th January. In addition to hydrographic observations, a dummy mooring was deployed at a water depth of 2000 m and retrieved at this location on 19th after activating the acoustic release system connected to the mooring line. The actual mooring operations started in the afternoon on the same day but due to the problems encountered with the mooring lines, the deployment was suspended till the next day. The mooring was laid on 20th and the ship sailed to Cochin to disembark Dr. J.S. Sastry after ascertaining the proper functioning of the acoustic release of Benthos make. From the outer anchorage, the ship proceeded to the receiver location at 3°N 82°E and reached

the position on 23rd at 1800 hrs.

Due to rough weather conditions, on 23rd and 24th at this location the drifting buoy could not be deployed. However, sonobuoys were released to receive the signals from the Heard Island transmitter. During the first two days signal reception was not satisfactory which was later found to be due to the mechanical snag at the transmitter end. Subsequently, signal reception has improved and the data could be recorded as per schedule. The drifting buoy was deployed at 0734 IST on 25th January at a water depth of 4000 m.

The drifting buoy was operational on 25th and 26th January. After a few receptions, the signals have been found to be quite wild. Hence, it was decided to recover the buoy. During recovery, the chord connecting the hydrophone and the buoy snapped while heaving on board. Further receptions were carried out using the sonobuoys. For the entire duration of the experiment, the drift was monitored at regular intervals through GPS. Sonobuoy observations continued upto 31st. In the early hours of 31st January the ship sailed towards Kalpeni Island to recover the deep sea mooring before proceeding to Goa.

On the 3rd February, 1991 attempts to recover the mooring by sending acoustic signals from the deck unit failed to yield positive response from the acoustic release unit (fixed in the mooring line 75 meters above the anchor weight). Several attempts were made to communicate with the acoustic release for two full days but of no avail. It was suspected that the formation of an acoustic, well defined, duct at the surface level (within the upper 100 m) associated with thermal inversions and prevailing strong surface currents must have contributed to the communication failure. Such near-surface temperature gradients or inversions are quite well known and have been documented to possess dramatic role on acoustic energy propagation in the upper ocean.

The ship returned to Mormugao harbour at 0900 hrs. on 6th February, 1991.

6. SIGNIFICANT FINDINGS

In receiving the acoustic signals, some rough preliminary comments can be made about signal to noise ratio, and speculations as to the optimum coherent processing time. These conclusions (speculations) are mainly drawn from cw and pentaline signals. Unfortunately, only two transmissions were

received on the deep sonobuoy. During a cw reception, and assuming roughly constant ambient noise during each reception, it seems the deep sonobuoy signal is up to 20 dB stronger than the 41B sonobuoy signal, for RMS spectra peaks. This might be attributed to the deeper sonobuoy's proximity to the sound channel axis. The stronger signal could be a combination of less noise in the bandpass range around 57 Hz at deeper depths, as well as a stronger signal. We seemed to be getting the best signal to noise ratios using 4 samples per demodulate coherent averaging, with a 1024 point fft. This corresponds to (1/228)*4*1024, or approximately 17 s. coherent averaging time. This seems very short, but SNR decreased when using 8 samples per demodulate and a 1024 fft, which doubles the averaging time. When using a 512 point fft and 8 samples per demodulate, again giving a 17 sec. coherent averaging time, signal to noise also goes down. The peak signal is now smeared over a wider bin width in frequency space. The best signal to noise rms received was nominally 40 db on the deep sonobuoy when receiving cw. On the 41B sonobuoy values using the optimum parameters described above gave a signal to noise ratio in the low to mid 20 dB range. Incoherent averaging over 10 to 30 ffts was sufficient. The m sequence receptions had visible carrier spikes, but the

peak signal to noise ratio was less as only half the energy is in the carrier. Off line processing cross-correlating the reception to the source function must be done to these transmissions. This should give additional processing gain.

7. LOSSES/DAMAGES

Sl.No.	Name of item	Qty.
1.	17" Glass spheres with hard hats (Benthos make)	24
2.	Aanderaa RCM 4 current meters with vane assemblies	4
3.	Accustic noise recorder with Aanderaa current meter casing	1
4.	Hydrophone (ITC 8020 A)	1
5.	Deep sea acoustic release (Benthos make)	1

8. ACKNOWLEDGEMENT

The Chief Scientist(s) and other participants are grateful to the Master, Officers and crew for their co-operation during the cruise.

TABLE-I SUMMARY OF CTD OBSERVATIONS (ORV SK, CR-61)

S.No	Date	Time	Sonic depth	Lat deg N	Long deg E	SST	Obs depth
1.	19-1-91	0120	2150	10 03.3	73 51.7	28.2	2150
2.	24-1-91	1350	4300	02 51.9	81 50.3	28.5	3056
3.	30-1-91	0525	4300	02 47.1	80 17.9	28.5	3290
4.	1-2-91	0900	1600	07 19.3	76 18.6	28.2	1445
5.	2-2-91	1315	2200	09 59.9	74 00.0	29.0	2087
6.	3-2-91	0535	2100	10 10.1	73 56.2	28.5	2021
7.	3-2-91	2110	2150	10 08.3	73 51.5	28.7	400
8.	4-2-91	0530	2100	10 01.1	73 52.6	28.5	406
9	4-2-91	1900	2100	10 11.8	73 53.17	28.5	415