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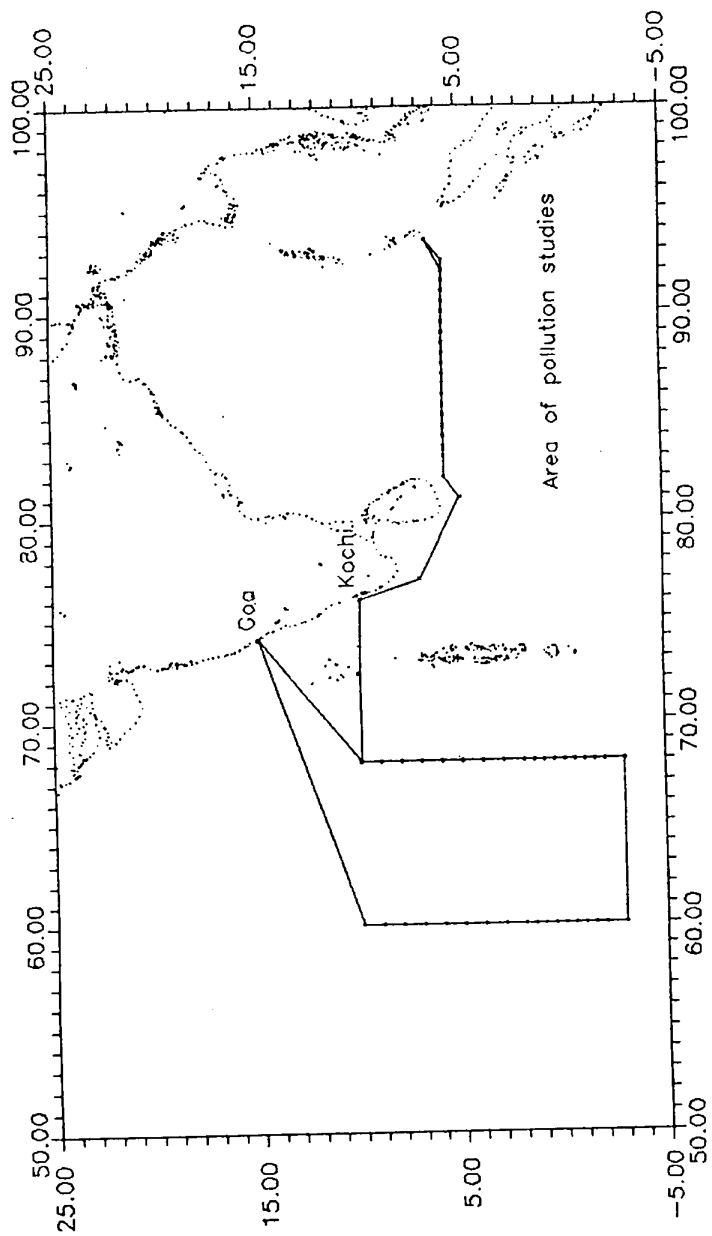
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ORV Sagar Kanya cruise 81 - 19 January to 9 March 1993



CRUISE TRACK

Fig. 1

## 2. CRUISE SUMMARY

The 81st cruise of ORV Sagar Kanya, which was originally planned to study the air-sea interaction processes and current systems in the Arabian Sea and Western Equatorial Indian Ocean during the winter season, was organised in two phases. During the first phase (Bay of Bengal studies), the impact of oil spill that occurred near the Nicobar islands due to the collision of two oil tankers off Malacca Strait on the marine environment was undertaken. The second phase (Arabian Sea studies) was devoted to the study of air-sea interaction processes, hydrography and circulation in the central Arabian Sea during the winter season. A total of 40 stations covering the international oil tanker route and oil spill site were occupied during the first phase. 5 CTD observations limited to 400 m depth, 34 hydrocasts upto 50 m depth, 37 Neuston net operations, 17 W.P net operations, 128 surface meteorological observations and 20 radio sonde ascents were also carried out as part of the pollution studies.

During the second phase, 36 CTD stations at 1 degree intervals along two longitudes 68°E and 60°E within the latitudinal belt 10°N to 3°S were occupied. The India Meteorological Department team conducted 3 hourly surface met. observations and twice daily radio sonde observations along the cruise track. One drifting buoy developed at NIO, Goa was deployed near the equator during this phase.

In addition to 16 NIO personnel, 12 participants representing India Meteorological Department, New Delhi; Indian Institute of Tropical Meteorology, Pune; Indian Navy and Kota Instrumentation Ltd. Rajasthan participated in the cruise.

### 3. PARTICIPANTS

#### (a) Scientific component:

N. Bahulayan	Chief Scientist
Y.V.B. Sarma	Dy. Chief Scientist
A.A. Fernandes	Physical Oceanography Div., NIO, Goa
K.J.K. Charyulu	-do-
M.T. Babu	-do-
M. Harikrishnan	-do-
K. Sen Gupta	Chemical Oceanography Div., NIO, Goa
S.N. Pai Fondekar	-do-
V.N. Sankaranarayanan	RC, NIO, Cochin
K.K.C. Nair	-do-
T.C. Gopalakrishnan	-do-
Ranu Gupta	-do-
Antony George	Shipboard Trainee, NIO, Goa
Atul Chelvan	-do-
B.S. Jawale	-do-
Pramod Kumar	-do-
A. Bhushan	Indian Navy
P.S. Latwal	-do-
I.J. Verma	IMD, New Delhi
D.C. Gupta	-do-
G.S. Nagrale	-do-
S. Devadoos	-do-
B.S. Tipse	IMD, New Delhi
Rajeev Mohaniya	-do-
V. Gopalakrishnan	IITM, Pune
G.C. Deshpande	-do-
Nalotpal Manna	Kota Instrumentation Ltd., Rajasthan

Note: Participants mentioned at Serial Nos. 3, 7 to 12, 17, 18 and 26 ave participated only during the first phase (Bay of Bengal studies).

Participants mentioned at Sl. Nos. 16, 27 and 28 participated only during the second phase of cruise (Arabian Sea studies) from 17/2/93 to 9/3/93. Scientists mentioned at Sl. Nos. 1, 2, 4 to 6, 13 to 15 and 19 to 25 in the list have participated during the entire duration of cruise from 19/1/93 to 9/3/93.

(b) Ship's Complement:

Arun D. Divekar	Master
Gurcharanjit Singh	Chief Officer
Naresh Sudhakar Nafrey	Third Officer
Kamal Kam Meena	TNO
Albert Rocha	Radio Officer
Shakti Bhadran	Purser
Dr. Malarmani	Medical Officer
Brijendranath Srivastava	Chief Engr.
Anil Gopal Sukthankar	Chief Engr.
Jahangir Madan	Second Engr.
Sukunta Dutta	Third Engr.
Shishiv Kanti Sikdar	Fifth Engr.
Kottayil Mathew John	El. Officer
Parbat Lal Chauhan	El. Officer
Wilfred Mascarenhas	Catg. Officer

Note: Anil Gopal Sukthankar, Chief Engr., participated only during second phase of the cruise (Arabian Sea studies).

Nicobar islands and its impact on the marine ecosystem of the area.

#### Phase II:

To understand the dynamics and thermodynamics that control the air-sea exchange processes and current systems in the Arabian Sea and western equatorial regions of Indian Ocean during the winter season of 1993.

### 5. CRUISE DETAILS

ORV Sagar Kanya sailed out from Mormugao harbour on 22/1/93 evening with 19 scientists and technical personnel onboard. The vessel reached the first station in the Arabian Sea (10°N, 68°E) on 24th January evening. While the CTD observation at the first station was being conducted, a message from the Director, NIO, Goa instructing the Chief Scientist and Master to divert the vessel to Bay of Bengal to study the oil spill pollution, was received at the vessel. The vessel was then first diverted to Cochin to take onboard 6 scientists who were specifically deputed to carry out oil pollution studies. The vessel with a total scientific complement of 25 reached the first observation point in the oil tanker route on 30/1/93.

A total of 22 stations at a space scale of 30 n.miles were worked out along the oil tanker route (Fig. 1). Hydrographic/CTD observations, Neuston and W.P nets operations for secondary production studies and collection of water samples for dissolved petroleum hydrocarbon (PHC) content and microbiological investigations were carried out along the oil tanker route. After reaching the oil spill area on 3rd February, 1993,

another 17 stations at a space scale of 15 n.miles along three transects were worked out. All the above mentioned observations were carried out in these 17 stations also (Figs. 2 and 3).

The scientists from IMD collected surface meteorological data at 3 hourly intervals at standard synoptic hours and upper air data on pressure, temperature and humidity through radio sonde ascents daily at 00 GMT and 12 GMT. A total of 128 surface met observations and 20 radio sonde ascents were carried out during the first phase of the cruise programme. The scientists from Indian Institute of Tropical Meteorology, Pune, measured atmospheric electrical conductivity and potential gradient for studying the atmospheric electrical parameters over the oceans and their relation to atmospheric pollution. All the observations for oil spill pollution were completed on 9th February and the vessel, after disembarking 4 scientists from the Regional Centre of NIO, Cochin at Cochin outer anchorage, reached Goa on 12th February, 1993. The Indian Navy team (2), 3 scientists from NIO, Goa and 1 scientist from IITM, Pune disembarked at Goa after the completion of the first phase of the cruise.

ORV Sagar Kanya was berthed for 5 days at Mormugao harbour for bunkering and provisions. Two scientists from Kota Instrumentation Ltd. and one graduate trainee from NIO, Goa, joined the vessel at Mormugao on 13th February, 1993 to participate in the second phase of the cruise (Arabian Sea studies). The vessel with a total scientific complement of 18 sailed out from Mormugao on 19/2/1993 for the scheduled programme in the Arabian Sea. It reached the first station (Station No.

41) in the Arabian Sea on 23/2/1993. A total of 36 CTD stations at the space interval of 1 degree along two meridional sections 60°E and 68°E within the latitude belt of 10°N and 3°S were occupied during the second phase. One drifting buoy was deployed near the equator and 68°E longitude on 2/3/1993. IMD team carried out 121 surface meteorological observations at 3 hourly intervals and 29 radio sonde ascents (twice daily) along the cruise track. CTD data were processed concurrently and vertical sections of temperature, salinity and T-S diagrams were prepared towards the end of the cruise.

All the observations were completed on 6/3/1993 and the vessel reached Mormugao harbour on 8/3/1993.

## 6. PRELIMINARY RESULTS

- (1) No floating tar particles were collected by both the plankton tows, horizontal and vertical. The secondary standing stock in the spill area appeared to be quite rich, particularly in the vicinity of Great Nicobar islands as is generally observed.
- (2) Zooplankton, in general, was dominated by chaetognaths, followed by copepods and hydrozoans.
- (3) The general ranges of concentration of DpH were 0.62-1.85, 0.31-1.54 and 0.31-1.54 at 0, 25 and 50 m depths respectively in the entire area examined.
- (4) The light transmission profiles recorded at 4 CTD stations showed only normal and expected pattern for oligotrophic waters. Absence of any reduction of transmission with depth in the upper layers indicated the absence of sinking oil in water globules/emulsions.



- (5) Winds were northwesterly, northerly and northeasterly during the entire cruise period. Wind speed upto 28 knots were observed in the Arabian Sea during the winter season.
- (6) Sea surface temperature varied between 27.5°C and 29.1°C in the Bay of Bengal, while it varied between 26.6°C and 29°C in the Arabian Sea.
- (7) Mixed upper layer depth was found to be very shallow (40 m) in both the sections near the equator. It increased to approximately 100 m in the northern latitude from 4°N to 10°N.

#### 7. LOSSES/DAMAGES

During the hydrocast operation at station no. 3 (5° 45.0'N; 82° 59.5'E), the entire hydrocast consisting of the following instruments was lost while hauling up the cast:

- i) Hydrobios bottles : 3 nos
- ii) Reversing thermometers : 3 nos.
- iii) Messengers : 3 nos.

It has been found that the PVC coated 4 mm hydrographic wire was rusted due to a cut in the PVC coating and hence the wire was snapped while the instruments were being hauled up. Towards the end of the cruise, approximately 100 m of the PVC coated hydrographic wire was cut off as a safety measure.

#### 8. ACKNOWLEDGEMENTS

The Chief Scientist and other members of the scientific team express their thanks to the Master, officers and crew of ORV Sagar Kanya for their excellent cooperation during the cruise.

## SUMMARY OF OBSERVATIONS

CRUISE NO. 81

SHIP: OCV SAGAR KANYA  
AREA: BAY OF BENGAL AND ARABIAN SEA

St. No.	Station No.	Date	Time (IST) (hrs)	Position		SJT/SJT	CTD/Hydrocast	W.R. met.	Observations			
				Latitude	Longitude				Surface met.	Bio-logical	Snapper	Others
1	1	24.1.93	1540-1720	10° 00'N	63° 00'E	-	1	-	1	-	-	-
2	2	30.1.93	1125-1200	5° 45'N	52° 00'E	-	1	-	1	-	1	1 (PHC)
3	3	30.1.93	1905-1930	5° 45.4'N	52° 59.5'E	-	1	-	1	-	1	-
4	4	31.1.93	0300-0345	5° 45.1'N	54° 50'E	-	1	-	1	-	1	1 (PHC)
5	5	31.1.93	1045-1140	5° 45'N	55° 00'E	-	1	1	1	-	1	1 (PHC)
6	6	31.1.93	1912-2000	5° 45'N	55° 58'E	-	1	1	1	-	1	1
7	7	1.2.93	0310-0400	5° 45'N	55° 59.8'E	-	1	1	1	-	1	1
8	8	1.2.93	1121-1200	5° 44.5'N	57° 59'E	-	1	1	1	-	1	1
9	9	1.2.93	1950-2040	5° 43.4'N	55° 59.0'E	-	1	1	1	-	1	1
10	10	2.2.93	0415-0500	5° 45'E	50° 00'E	-	1	1	1	-	1	1
11	11	2.2.93	1300-1240	5° 44.9'N	51° 00.9'E	-	1	1	1	-	1	1
12	12	2.2.93	1945-2030	5° 45'N	52° 00'E	-	1	1	1	-	1	2
13	13	3.2.93	1040-1200	5° 40.2'N	53° 29.8'E	-	1	1	1	-	1	1 (PHC)
14	14	3.2.93	1452-1540	5° 42'N	52° 46'E	-	-	-	1	-	1	1
15	15	3.2.93	1330-1957	5° 43'N	52° 02'E	-	1	-	1	-	1	3

St. No.	Station No.	Date	Time (IST) (hrs)	Position		NBT/NST	CTD/ hydrocast	W.R	Observations			
				Latitude	Longitude				Surface met.	Bfalo- g/cal	Snapper	Others
16	16	3.2.93	2240-2320	6° 44.8'N	94° 16.4'E	-	1	-	1	2	-	1
17	17	4.2.93	0230-0341	6° 43.9'N	94° 36'E	-	1	-	1	2	-	1
18	18	4.2.93	0600-0700	6° 34'N	94° 44'E	-	-	1	1	2	-	1
19	19	4.2.93	1053-1210	6° 22.5'N	94° 51.8'E	-	1	1	1	3	-	1
20	20	4.2.93	1420-1456	6° 17'N	94° 34.7'E	-	1	1	1	2	-	1
21	21	4.2.93	1655-1810	6° 30'N	94° 29'E	-	1	1	1	2	-	1
22	22	4.2.93	2000-2025	6° 22.0'N	94° 12.2'E	-	1	1	1	2	-	1
23	23	4.2.93	2330-0012	6° 14.5'N	94° 16.3'E	-	1	1	1	2	-	1
24	24	5.2.93	0130-0220	6° 12.3'N	94° 04.3'E	-	1	1	1	2	-	1
25	25	5.2.93	0345-0445	6° 23.7'N	93° 56.8'E	-	1	1	1	2	-	1
26	26	5.2.93	0345-0445	6° 22.4'N	93° 41.4'E	-	1	1	1	2	-	1
27	27	5.2.93	1730-1830	6° 07'N	93° 46'E	-	1	1	1	2	-	1
28	28	5.2.93	2035-2105	6° 4.5'N	93° 39.3'E	-	1	1	1	2	-	1
29	29	5.2.93	2310-2335	5° 17.0'N	93° 24.3'E	-	1	1	1	3	-	1
30	30	5.2.93	0515-0555	5° 45'N	92° 30'E	-	1	1	1	2	-	1
31	31	5.2.93	1255-1330	5° 47'N	91° 30'E	-	1	1	1	1	-	1
32	32	6.2.93	2020-2030	5° 44.7'N	90° 30.2'E	-	1	1	1	1	-	1
33	33	7.2.93	0307-0325	5° 45.1'N	89° 30'E	-	1	1	1	1	-	1
34	34	7.2.93	0754-1020	5° 44.7'N	88° 30.2'E	-	1	1	1	1	-	1
35	35	7.2.93	1150-1720	5° 45'N	87° 30.02'E	-	1	-	1	1	-	1

SI. No.	Station No.	Date	Time (IST) (hrs)	Position		MBT/ XBT	CTD/ Hydrocast	W.R	Observations			
				Latitude	Longitude				Surface met.	Bio- gical	Snapper	Others
36	36	7.2.93	2326-2340	5° 44'N	86° 29.9'E	-	1	-	1	1	-	1
37	37	8.2.93	0621-0632	5° 45'N	85° 30'E	-	1	-	1	1	-	1
38	38	8.2.93	1248-1305	5° 45'N	84° 30'E	-	1	-	1	1	-	1
39	39	8.2.93	1930-1950	5° 45.7'N	83° 30'E	-	1	-	1	1	-	1
40	40	9.2.93	0150-0210	5° 45.1'N	82° 30'E	-	1	-	1	1	-	1
41	41	23.2.93	0930-1130	9° 59.9'N	59° 59.9'E	-	1	-	1	1	-	-
42	42	23.2.93	1700-1855	9° 00.9'N	60° 00'E	-	1	-	1	1	-	-
43	43	24.2.93	0130-0230	7° 59.5'N	60° 00'E	-	1	-	1	1	-	-
44	44	24.2.93	0846-0934	7° 00.25'N	59° 59.96'E	-	1	-	1	1	-	-
45	45	24.2.93	1620-1710	6° 00.68'N	59° 59.99'E	-	1	-	1	1	-	-
46	46	24.2.93	2330-2400	5° 00.23'N	59° 59.95'E	-	1	-	1	1	-	-
47	47	25.2.93	0725-0800	3° 57.7'N	59° 59.62'E	-	1	-	1	1	-	-
48	48	25.2.93	1326-1550	3° 00.75'N	59° 59.3'E	-	1	1	1	1	-	-
49	49	25.2.93	2225-2356	2° 00.1'N	59° 59.6'E	-	1	1	1	1	-	-
50	50	26.2.93	0330-0416	1° 30.9'N	59° 59.63'E	-	1	1	1	1	-	-
51	51	26.2.93	0743-0904	1° 00.31'N	60° 00.2'E	-	1	1	1	1	-	-
52	52	25.2.93	1230-1334	0° 30.05'N	60° 00.7'E	-	1	-	1	1	-	-
53	53	26.2.93	1643-1727	0° 00.51'N	59° 59.97'E	-	1	-	1	1	-	-
54	54	26.2.93	2043-2222	0° 31'S	59° 57.4'E	-	1	1	1	1	-	-
55	55	27.2.93	0139-0220	0° 59.5'S	59° 58.43'E	-	1	1	1	1	-	-

St. No.	Station No.	Date	Time (IST) (hrs)	Position		MBT/ XBT	CTD/ Hydrocast	Observations				
				Latitude	Longitude			W.R	Surface met.	Btolo- gical	Snapper	Others
56		27.2.93	0725-0827	1° 30.98'S	59° 59.47'E	-	1	1	1	-	-	-
57		27.2.93	1130-1230	1° 59.85'S	60° 00.7'E	-	1	1	1	-	-	-
58		27.2.93	1814-1923	3° 00.3'S	60° 00.1'E	-	1	1	1	-	-	-
59		1.3.93	2100-2143	3° 00.76'S	68° 00.22'E	-	1	1	1	-	-	-
60		2.3.93	0448-0551	2° 00.91'S	67° 59.96'E	-	1	1	1	-	-	-
61		2.3.93	0950-1030	1° 30.47'S	68° 00.1'E	-	1	1	1	-	-	-
62		2.3.93	1520-1600	1° 00.56'S	68° 00.6'E	-	1	1	1	-	-	-
63		2.3.93	2015-2125	0° 30.73'S	67° 59.1'E	-	1	1	1	-	-	-
64		3.3.93	0118-0230	0° 00.01'N	68° 01.05'E	-	1	1	1	-	-	-
65		3.3.93	0556-0700	0° 30.56'N	68° 00.47'E	-	1	1	1	-	-	-
66		3.3.93	1030-1130	1° 00.31'N	68° 00.74'E	-	1	1	1	-	-	-
67		3.3.93	1452-1541	1° 31.26'N	68° 00.73'E	-	1	1	1	-	-	-
68		3.3.93	1902-1958	2° 01.42'N	68° 00.84'E	-	1	1	1	-	-	-
69		4.3.93	0152-0303	3° 00.13'N	68° 00.4'E	-	1	1	1	-	-	-
70		4.3.93	0925-1018	3° 59.75'N	68° 30.54'E	-	1	1	1	-	-	-
71		4.3.93	1653-1756	4° 59.75'N	68° 50.40'E	-	1	1	1	-	-	-
72		5.3.93	0033-0130	6° 00.4'N	63° 00.1'E	-	1	1	1	-	-	-
73		5.3.93	0740-0851	7° 00.6'N	68° 00.1'E	-	1	1	1	-	-	-
74		5.3.93	1510-1550	8° 00.28'N	68° 00.6'E	-	1	1	1	-	-	-
75		5.3.93	2223-2335	9° 00'N	63° 00.08'E	-	1	1	1	-	-	-
76		6.3.93	0640-0735	10° 00.69'N	63° 01.66'E	-	1	1	1	-	-	-

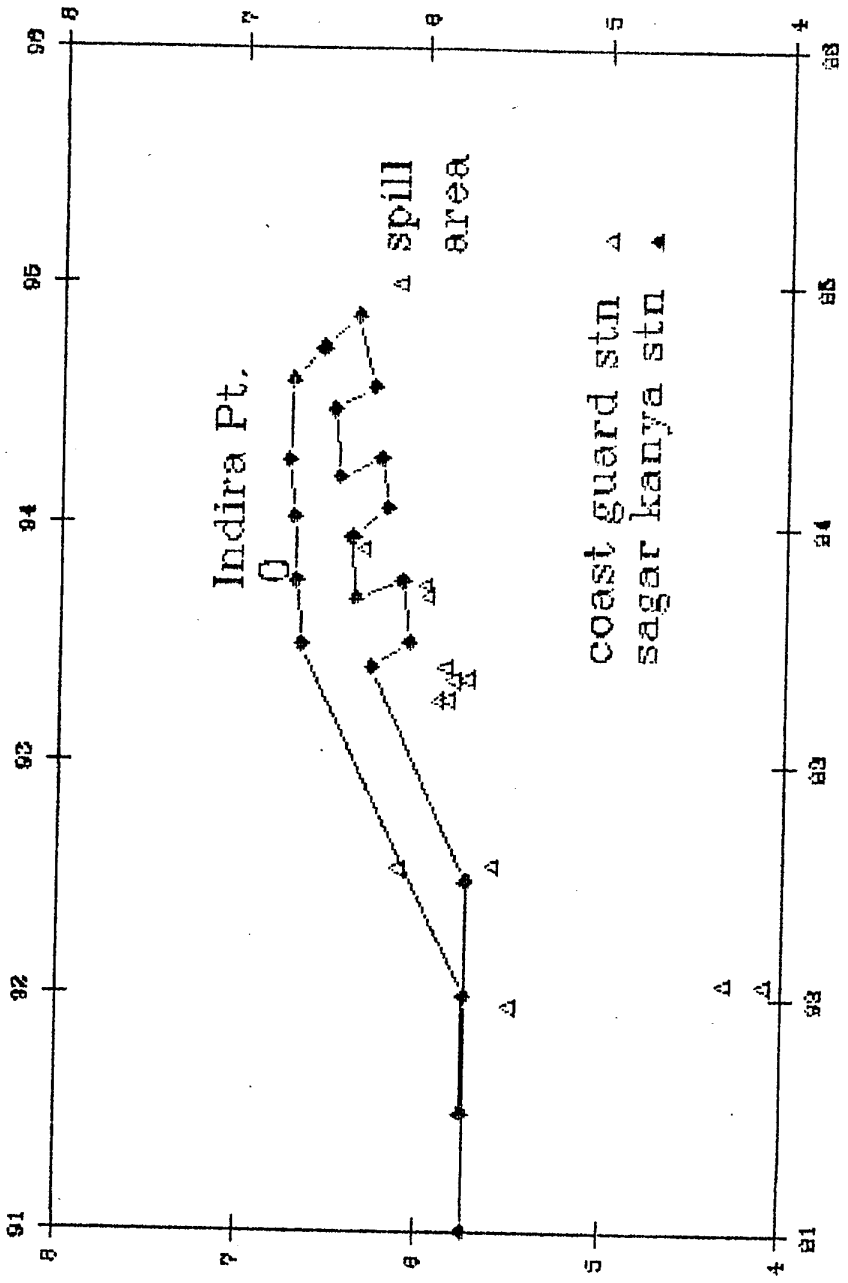


Fig. 2. Cruise tracks in oil spill area in Great Channel.

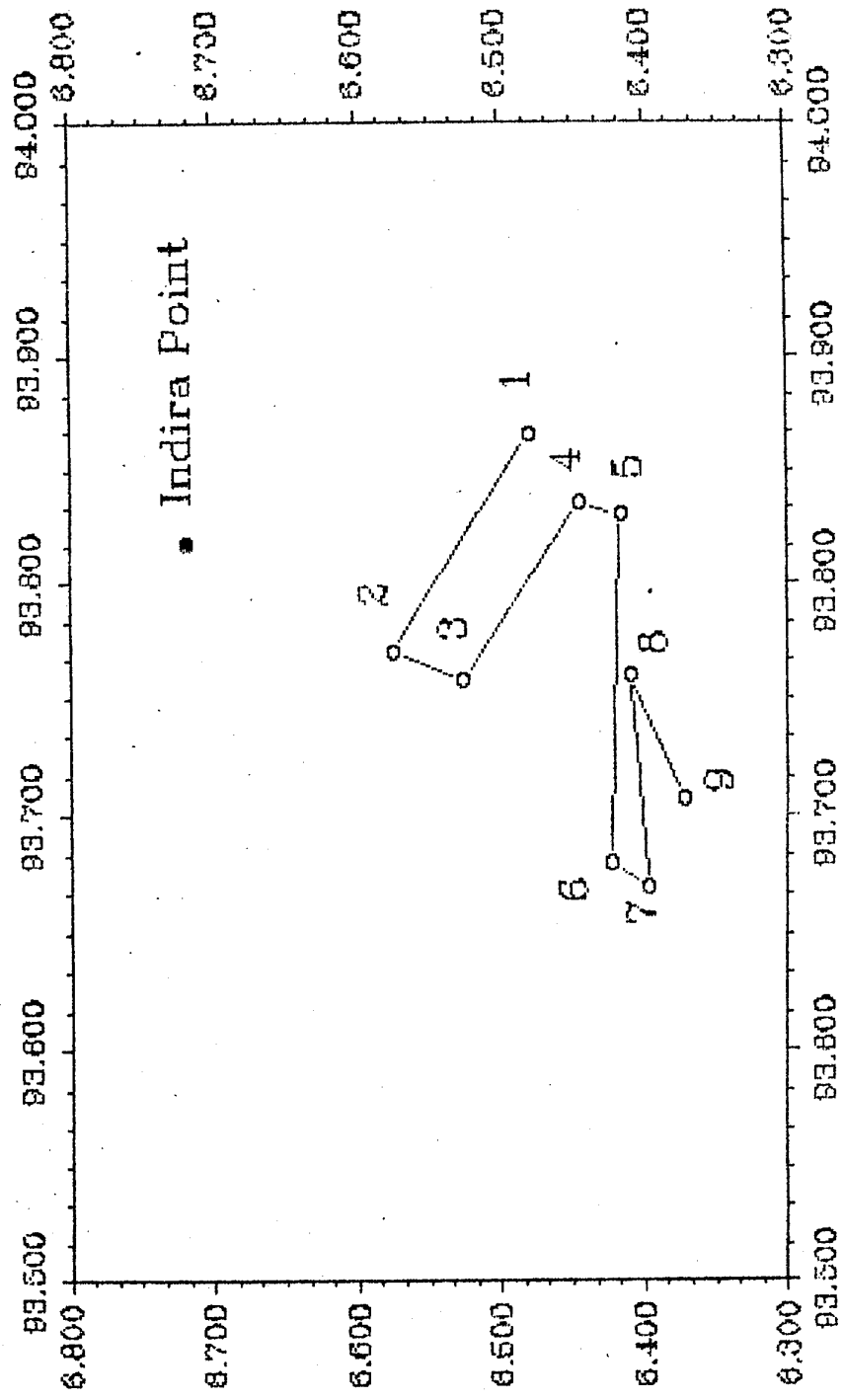


Fig. 3. Search for oil slick in the Andaman Sea.